THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. VI. No. 119—9th YEAR.] LONDON, MAY 12, 1857. [Subscription per Ann. 15s. in Advance 18s. Credit. Unstamped. Price 6d.

FIRE-CLAY Retorts and Fire Goods.
The Advertiser has brought his Fire-Clay Retorts to great perfection, both as to quality and finish. Many have stood three and four years.
Every description of Fire Goods in any quantity always on hand. The Fire Clay is the very best in the North of England. Stock never less than 10,000 tons weathering.
Orders promptly executed.
Apply, G. H. RAMSAY, of Derwenthaugh Fire-Brick Works, near NEWCASTLE-ON-TYNE.
Aug. 22, 1856.

TO GASHOLDER MAKERS AND OTHERS.

THE Directors of the Ashton-under-LYNE Gas Company are prepared to receive TENDERS for Supplying and Fixing a two-lift TELESCOPE GASHOLDER, 75 feet diameter, and together 48 feet deep, with Suspensions, Columns, Pulleys, &c.
Plans and Specifications may be seen, and further information obtained at the Company's Offices, ASHTON-UNDER-LYNE.
Copies of Specifications may be had on payment of 5s.
Tenders to be sent in on or before Wednesday, the 27th of May inst.
The Directors do not pledge themselves to accept the lowest or any tender.
By Order of the Directors.
Gas Offices, Ashton-under-Lyne, May 4, 1857.

DINAS FIRE BRICKS, RETORTS, AND CEMENTS.
YOUNG & ALLEN,
MANUFACTURERS OF DINAS FIRE BRICKS AND RETORTS,
NEATH, GLAMORGANSHIRE,
Beg to draw the attention of the Engineers and Managers of Gas-works to the superior quality of their goods, and more especially to their BRICK RETORTS, which, in addition to the almost infusible nature of the Fire-Clay employed, have the great advantage, from its large excess of Silica, of EXPANDING BY THE APPLICATION OF HEAT, and consequently becoming sounder and less liable to leak by use. Their cost is less than that of the ordinary Clay Retorts.
Young and Allen's DINAS FIRE-BRICKS and CEMENT have been long used for the linings of furnaces exposed to high temperatures, and are well known in the London and other Gas-works. They can be forwarded by rail to all parts of the United Kingdom, and shipped by sea to all parts of the world.
Prices on application as above.

BRYAN DONKIN and CO.'s improved GAS VALVES have been adopted by numerous Gas Companies in England and abroad, and their advantages and great security fully proved. Very large numbers are in use. Prices from 11s. 6d. to 13s. 6d. per inch diameter.
BRYAN DONKIN and Co.,
Engineers, near Grange Road, BERMONDSEY.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOS. COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE.
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS RETORTS and OTHER OBJECTS in FIRE CLAY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire Clay Retorts in the United Kingdom; and orders for Fire Clay Retorts of all shapes and dimensions, Fire Bricks, and every other article in Fire Clay, are promptly executed at their works as above.
COWEN'S GARESFIELD COAL AND COKE.
Coal and Coke Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.
JOHN RUSSELL AND CO.,
THE OLD TUBE WORKS,
CHURCH HILL, WEDNESBURY,
STAFFORDSHIRE,
and 69, UPPER THAMES STREET, LONDON,
Original Manufacturers of Wrought-Iron Gas Tubes, and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest Orders may be executed in a few days.
The eminent Engineer, Mr. Perkins, confines himself altogether to the use of John Russell and Co.'s Tubes in his High-Pressure Steam Patents.
Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanised Tubes, &c.
N.B. All Goods thoroughly Tested before sent out, and Warranted.

CHARLES BOTTEN and SON,
ENGINEERS AND METER-MAKERS,
CRAWFORD PASSAGE, RAY STREET,
CLERKENWELL, LONDON (E. C.).
Manufacturers of Station and Patent Protector Consumers' Meters, Patent Slide-Valves, Gas-Fittings, Pipes, &c.
Also, High-pressure Cocks, Hydrants, Closets, and all Water-Fittings.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS, NEAR NEWCASTLE-ON-TYNE.
WILLIAM COCHRAN CARR,
begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the Manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other Articles in Fire-Clay, executed on the shortest notice and on the most reasonable terms.
London Agents:
JAMES LAWRIE & CO.,
63, OLD BROAD STREET, CITY, LONDON.

WANTED, by the Bedworth Gas-LIGHT and COKE COMPANY, a good Working FOREMAN or MANAGER. He must be well acquainted with the Manufacture and Distribution of Gas, the Setting and Management of Retorts, the Laying and Renewal of Street Mains, Services, Fixing Meters, and Interior Fittings.
In addition to a fixed Salary, he will have the use of a good house and garden, gas, firing, rates, and taxes free.
Applications, post free, stating age, qualifications, reference as to character, &c., to be addressed to Mr. STALEY, BEDWORTH.

TO GASHOLDER MAKERS AND OTHERS.
PERSONS willing to contract for the Supply and Erection, at Dunstable, Beds, of a GASHOLDER, 40 feet diameter and 16 feet deep, suspended by at least four points, and counterbalanced so as to reduce the pressure to one inch of water, are invited to send TENDERS, accompanied by Specifications, to C. S. BENNING, Esq., Secretary to the Dunstable Gas Company, DUNSTABLE, on or before the 20th instant.
For any further information apply to THOMAS G. BARLOW, Esq., 3, Parliament Street, LONDON, S.W.

EIGHTON MOOR GAS COALS.—Parties wishing to be supplied with these first-class Gas Coals will please to apply to Mr. MATTHEW NESBIT, EIGHTON MOOR OFFICE, NEWCASTLE-UPON-TYNE. These coals are well known as among the richest in gas, and working the roundest on the River Tyne. They are extensively used by metropolitan gas works.

PADDON AND FORD,
PATENT GAS METER & APPARATUS WORKS,
GRAY'S-INN-ROAD, LONDON,
Manufacturers of WET and DRY GAS METERS, STATION METERS, GOVERNORS, EXPERIMENTAL APPARATUS, GAS STOVES, and LANTERNS.
Contractors for the erection or alteration of Gas Works; and every description of Apparatus required in Gas Works supplied.

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WEDNESBURY, STAFFORDSHIRE, and 81, UPPER GROUND STREET, BLACKFRIARS, LONDON
PATENTEES, INVENTORS, AND FIRST MAKERS OF
WROUGHT-IRON GAS TUBING,
commencing from the *earliest* introduction of Gas Lighting into this country.
Manufacturers of every size and description of Wrought-iron Tubes and Fittings, from one-eighth up to seven-inch internal diameter, for Gas, Steam, or Water.
PATENTEES AND MANUFACTURERS OF THE
LAP-WELDED FLUES,
for Marine, Locomotive, and Stationary Boilers.
Inventors and Manufacturers of
IMPROVED STEAM AND GAS COCKS,
in Iron or Gun Metal, from three-eighths to six-inch bore. Manufacturers of every description of hand-screwing
STOCKS, DIES, AND TAPS,
for Gasfitters and Engineering purposes.
Manufacturers of Coils, for hot water and other purposes; Casing of all sizes, with flush joints, for Well-sinkers; Blasting Tubes; Buffer Tubes for Railway Carriages; Tubes for Roller Beams; Spindles, Shafts, Pendulums, Hydraulic Presses, Core Bars, Steam Gauges, &c. &c.
JAMES RUSSELL and SONS beg to call the attention of Engineers, Builders, Water Companies, and others, to their
PATENT ENAMELLED TUBES,
which preserve water or other liquids conveyed by them in a perfectly limpid condition; whilst the Enamel itself is as pure as the finest Porcelain, possessing the rare recommendation of being entirely free from any noxious ingredient in its composition.
Lists, Estimates, &c. &c., forwarded on application; orders, from 10 to 100,000 feet of gas tube, executed at twelve hours' notice if required; and quality may be safely relied upon, as all goods are most carefully tested before leaving the Works.
JAMES RUSSELL and SONS have great pleasure in calling attention to the annexed award:—
"EXHIBITION OF THE INDUSTRY OF ALL NATIONS, NEW YORK.
"Office: No. 6, Charing-cross, London, April 6, 1854.
"Gentlemen,—I have much pleasure in informing you that the Jury has awarded to your firm 'HONOURABLE MENTION FOR LAP-WELDED IRON TUBES.' You are at full liberty, if you deem it likely to promote your mercantile advantage, to affix to these articles, during the season 1854, a card whereon this Award is printed, and also your prices, with name of agent, &c.—I am, gentlemen, your obedient servant,
"JOHN H. BONN, Secretary.
"MESSRS. JAMES RUSSELL and SONS, Wednesbury, STAFFORDSHIRE."

JOURNAL OF GAS LIGHT NEWSPAPER PENNY

By Her Majesty's Royal Letters Patent.

JAMES MEACOCK,

MANUFACTURER OF

PATENT DRY AND IMPROVED WET METERS,

Also of every Description of Apparatus used in the Gas Factory, as well as in Gas Distribution.

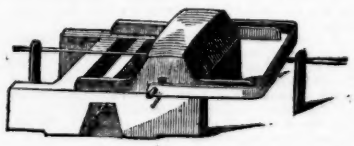
7, SNOW HILL, & GILTSPUR STREET, LONDON.

Established 1836.

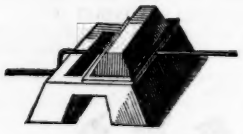
PATRONISED BY ALL THE GAS COMPANIES OF THE METROPOLIS, AS WELL AS MOST OF THE PROVINCIAL TOWNS.

J. MEACOCK, in returning thanks for the liberal favours he has received, most respectfully calls the attention of those interested in Gas Lighting to the improvements of his DRY METER, which has obtained HER MAJESTY'S ROYAL LETTERS PATENT, and which contains all the desired requisites for simplicity, durability, and faithful registration; also to his improved WET GAS-METER, which all the leading Gas Companies have been pleased to patronise; and begs to solicit the continuance of their commands for the above, as well as *Experimental and Station-Meters*, Pressure-Indicators, Governors, Gauges, Photometers, and every apparatus in use by the Gas Engineer, which he will warrant of the very best materials and workmanship, and at most economical charges.

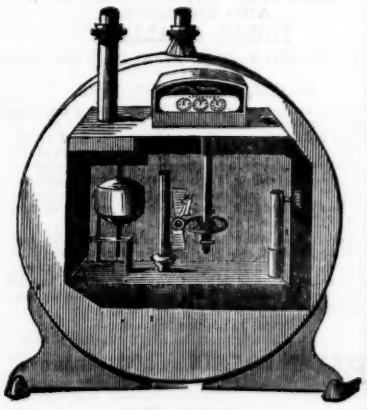
J. MEACOCK'S PATENT DRY METER.



NEW VALVE OF J. MEACOCK'S PATENT DRY METER.



OLD VALVE OF THE ORDINARY DRY GAS-METER.



J. MEACOCK'S IMPROVED WET METER.

In the above Diagrams of Meters will be seen J. MEACOCK'S patent method of securing the Leather Diaphragm of his IMPROVED PATENT DRY METER. Instead of using the soldering iron for the purpose, by which the Leather is more or less injured, it is held between two flat Metal Rings, and screwed up sound on to a frame to receive it, the outward rim of which and screw-heads are shown in the drawing.

The Valve adopted in the above Patent Meter is also shown, as well as the ordinary Slide-Valve; the advantages of the former in not rising from its facing will be very apparent to the practical Gas Engineer, to whom it is of vital import.

WET GAS-METERS REPAIRED AND RECONSTRUCTED WITH J. MEACOCK'S MODERN IMPROVEMENTS.

J. MEACOCK begs leave most respectfully to submit to the notice of Gas Companies his PATENT DRY GAS-METER, trusting thereby to receive the same encouragement that has been so kindly awarded him in respect of his Improved Water Meter, which has been patronised by all the Metropolitan Companies, as well as most of the Provincial Gas-works.

The public having been induced to desire Dry Gas-Meters in preference to Wet, and many Gas Companies being willing to yield to their wishes, if a correct measurer, not liable to fluctuation of registry, of good materials and workmanship, and when repair was necessary, of being put in order by simple means, J. M. has been induced to apply himself to the production of a Dry Meter, possessing those requisites, for which he has obtained her Majesty's Royal Letters Patent.

It is not generally known, but very frequently in fitting up the ordinary Dry Meter, the leather of the diaphragm is destroyed during the process of soldering, by coming in contact with the hot soldering iron. In his present process, J. M. has done away with its use, no solder being necessary, the leather being secured by two flat metal rings, between which it is screwed, rivetted, or overlaid; the perishing effect of hot tools to leather being avoided, its durability must be longer; also, by this means, its repair when needful is most simple, as a new leather diaphragm can be applied by merely unscrewing the old one from the rim or frame to which it had previously been screwed up sound.

In the ordinary Dry Meter frequent variations of registry have been detectable from defective valves, which tilt or rise from their facings: the slide-valve of this Patent Dry Meter will not allow any carbonaceous matter common to coal gas to tilt or lift the slide from its facings, and hence no variation. It will be found not only a correct measurer, but free from fluctuation.

The heavy wear and tear to which the Meters of Gas Companies are subject, have at all times made it desirable to have them of the best materials and workmanship. Unfortunately, in the greater number of the ordinary Dry Meters, neither of these requisites were carried out, for, as they were not to contain water, most inferior workmen and materials were employed in their construction. J. M. begs leave to assure those who may honour him with their commands, that nothing but the stoutest materials for cases, the hardest gas-resisting metals, and best foreign leather for the interiors, will be used, and none but first-class workmen employed in their construction (the properties which his Improved Water Meter is well known to possess, and which has obtained him that extensive patronage), will be strictly carried out in his PATENT DRY METER.

In respect of any orders with which he may be honoured, he is willing to give a stamped guarantee to keep the same in repair, *free of all charge*, for five years, and allow the customary discount off the original list price.

J. M. has annexed diagrams of his Patent Dry, also of his Improved Wet, Gas-Meter. In the former will be seen his patent mode of securing the diaphragm. The former and present valve are also shown, and the advantages of the latter will be, by practical persons, easily understood.

METERS SENT ON APPROVAL.

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TO CORRESPONDENTS.

G. R. Booth.—*We are unable to perceive in what respect the passage in the "Digest of Legal Intelligence" to which you refer is inaccurate. In the first trial of* Booth *v.* Kennard *the plaintiff declined to take the opinion of the jury on the validity of his first patent, and a verdict was given for the defendant in respect of the second patent. A new trial was ordered, with a similar result; and the Court of Exchequer, upon a recent motion for a third trial, held that the second patent was void on the ground of its want of novelty. A verbatim report of that judgment will be found in another column.*

T. H. H.—*The telegraphic wire carried through the principal gas main, between the office of the Great Central Gas Company and the works at Bow Common, has long since ceased to be used. The gutta percha coating of the wire was rapidly acted upon by the naphtha vapours of the gas, and the electric current became gradually more feeble till it entirely ceased.*

Lex.—*Our reports of the cause of* Hills *v.* The London Gas Company *were supplied by a shorthand writer specially engaged by us, and are admitted by all parties to be faithful records of the proceedings.*

NOTICES.

Subscribers who have not yet paid their subscriptions (1856) are requested to remit 18s. for the entire year, or 9s. for the half year, by Post-Office order, payable to Thomas G. Barlow, at the Charing-Cross Money-Order Office.

The subscription is 15s. per annum, if paid in advance, or 18s. on credit, payable in two sums of 9s. each, due in July and January of each year.

The next number will be published on Tuesday, May 26, and the subsequent numbers on each successive alternate Tuesday, till our project of weekly publication is carried into effect.

Stamped copies, when forwarded by post, must be folded so as to expose the stamp; they are otherwise liable to the full postage charge for letters.

This Journal has been duly registered at the General Post Office for transmission abroad.

All Communications to be addressed to the Editor, No. 3, Parliament Street, Westminster; and orders for Advertisements to Mr. W. B. King, the Publisher, No. 11, Bolt Court, Fleet Street.

ERRATA.

In the table given at page 27, Vol. III., of the discharge of gas through an 8-inch pipe 1750 yards long, with 1 inch pressure, *for* 10,350 feet, *read* 9237 feet. To avoid mistakes this error had better be at once corrected with a pen.

In the foot-note (*g*) at page 194 of the last number *for* £3 *read* 3s.

" " (*h*) " " "

for	£4.	0s.	0d.	*read*	4s.	0d.
"	£3.	10s.	0d.	"	3s.	10d.
"	£3.	8s.	0d.	"	3s.	8d.
"	£3.	6s.	0d.	"	3s.	6d.
"	£3.	4s.	0d.	"	3s.	4d.
"	£3.	2s.	0d.	"	3s.	2d.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 12, 1857.

NOTES UPON PASSING EVENTS.

The parochial authorities of the metropolitan districts upon the south side of the Thames appear lately to have been very energetic in their efforts to suppress the nuisances arising from trade operations; and excited, perhaps, by the glory gained by their Islington colleagues in the crusade against brick-making, they have commenced an attack upon the blood-manure manufacturers, and the driers of damaged corn, who are located in the classical and odoriferous regions of Dock-head and Horsleydown. Provided this care for public health does not degenerate into unnecessary interference with business, everybody ought to applaud its authors; and certainly the proceedings which have hitherto been taken under the powers of the Nuisances Removal Act, &c., have proved that the parishes are far more likely to act with justice and common sense in these matters than any police inspectors. But it is to be feared that the mania for controlling this class of operations may extend; and already the medical officers of the various parishes have banded together to concoct some wonderful scheme for the management of gas-works. We warn manufacturers, therefore, once more of the danger to which they are exposed; for they may depend upon it that there is no more vexatious or absurd tyranny than that which is exercised by so-called scientific men, or even by municipal authorities, under the plea of protecting the public health, unless it be that which is exercised by the State.

There has occurred lately one curious illustration of the danger of attaching undue importance to the opinions of the class we allude to. In Paris there is a *Conseil de Salubrité* composed of the most celebrated medical, chemical, engineering, architectural, and administrative authorities of the capital, who, amongst other duties, issue an annual report upon the various technical questions relating to the public health which have come before their notice in the course of the year. They have recently published one of these documents, and in it they mention, in very warm terms of approbation, a certain M. Mallet's process for purifying coal gas by passing it through roasted sulphate of lead. Now, if our readers would refer to the number of this Journal for Dec. 10, 1850 (p. 341), they would find a notice of a patent, taken out by the late G. Michels, dated April 30, 1850, for precisely the same thing; so that the *Conseil de Salubrité* is, in fact, awarding praise to a man who very probably is no better than a plagiarist—just as the *Académie des Sciences* itself, some time since, awarded praise to the plagiarists of Dr. Clark's process for softening water—and (which was more mischievous) they have recommended a process proved to be inapplicable on account of its expense. The fact is, that "cobblers should stick to their last:" when medical men, architects, &c., undertake to teach manufacturers how to conduct their business, they are sure either to display their own ignorance, or to do mischief.

Another valuable lesson might be learnt by our fashionable socialists, or, as they call themselves, social reformers, from the more recent French journals. It would appear from them, that precisely at the moment that the Administration of the City of Paris is congratulating itself upon the bargain lately concluded with the Gas Company, whereby the latter has the monopoly of the public lighting for a certain number of years, the electric light is being so much improved that there seems to be a great probability—if the French journals can be trusted—of its being substituted for gas in street lighting. We have reasons to believe that this probability is almost a possibility; for we have personally assisted at some experimental trials of a new method of obtaining the electric light which leave no doubt in our minds as to its eventually being perfected, so far as its mechanism is concerned. It may be many years before the practical and economical application of the system we have examined can be sufficiently brought under control to enable it to enter seriously into competition with gas. But the point to which we particularly wish to call attention is this, viz., that if by any such improvement, or any advance of science, the existing mode of lighting should be found to be manifestly worse or dearer than the supposed new mode, the whole of the public funds invested in

gas-works, as at Manchester, or of the private funds invested on faith of a public contract, as at Paris, would be lost; or else the towns so compromised would be compelled to remain, literally, in comparative darkness. The moral we draw from these tales about "new lights" is, in fact, that there is always danger in a state's, or a town's turning manufacturer on its own account, let its operations be managed ever so honourably.

Will the new House of Parliament dare to ask for a committee to inquire into the working of the Public Health Act before accepting the Government measure for its continuance? It is to be feared that it will not; and that the monstrous jobbery and incompetence (to quote Sir B. Hall, when out of office) of that singularly useless body, the General Board of Health, will thus escape exposure. There are various rumours abroad as to the intentions of ministers on the subject of the Act itself; some, to the effect that the board is to be endowed with increased powers; some, that it is to be suppressed, and its duties transferred to the Home Office. We hope that the latter will prove to be the more correct; but, unfortunately, our *strong* Government can hardly exist, unless it has the disposal of a great many places, and, moreover, the news is "too good to be true:" we therefore urge our friends to keep still on the alert against the intrigues of the General Board of Health. In the meantime, it may be worth mentioning that the celebrated model town of Southampton remains in great trouble with respect to the outfalls of its sewerage; that Croydon is equally at a *nonplus;* that the drainage and water supply of Rugby are seriously defective; and that Salisbury is likely to be seriously inconvenienced by the loss of water which takes place in the sewers, or by the waste in the houses. What a commentary do these facts present upon the statements made to the Brussels Congress of last autumn, endorsed as those statements were by the presence, and the tacit consent, of Messrs. Cowper, Chadwick, Farr, Simon, Ewart, &c.! Who will vindicate the scientific reputation of England which was then so disgraced before assembled Europe?

In another part of our JOURNAL will be found some remarks upon the designs sent in for the competition for the Palaces of Administration; but, here, we are anxious to revert to a part of the subject, in order again to call attention to the unsatisfactory report by Captain Burstal upon the bed of the Thames; because we consider it to have been as injurious to the scientific reputation of our country as even Mr. Ward's exhibition at Brussels. Will it be believed that in this last costly blue-book upon the state of the Thames no reference is made to the effect of the dredging which is constantly going on in it? A mere casual inspection of the sections given would suffice to show to even an unprofessional eye that the most striking differences between the bed of the river in 1823 and in 1856 are of the character which would have accompanied dredging operations; and it happens precisely that large quantities of sand have been removed from the part of the river between Vauxhall and Putney Bridge, and that, in the especial case paraded by Captain Burstal—viz., the Westminster Bridge itself, new channels were actually dredged for the steamboat traffic. No attempt is made, either, to explain the occasional deepenings of the river, above and below the obstructions to the flow of the tides; but the extremes of these deepenings are taken as indications of what may become the normal depth of the river. Now, any engineer who is at all acquainted with hydraulic works must know that when the width of a stream is contracted by a bridge, or otherwise, the increased velocity of the stream will infallibly cause the bed to be lowered on the down side, or, in a tidal river, on both up and down side. Neither the depth at the Pool nor the depth at Vauxhall are, we contend, proved to be normal depths; nor, even if they were, could the general line of the river's bed be lowered to them, unless all our existing bridges were sacrificed. A full examination of the whole question of the past and present state of the Thames is, indeed, required to enable our public authorities to deal with the metropolitan bridges; but it must be made by very different parties than those who have latterly mystified the public.

In our correspondence will be seen a letter from Messrs. Hare and Whitfield, in which those gentlemen complain of the stringency of our remarks upon them, but which we think goes far to confirm the opinion we then expressed. They say that, firstly, "the overseers considered the proper mode of assessing the company would have been upon such a proportionate sum of profit as the works in Putney were instrumental in producing;" and that, secondly, "they applied to the company for a particular of receipts and expenses, to enable them to arrive at a just conclusion," &c. Further on they state that, not having received this "particular," they took a per centage upon the outlay expended by the company in the erection of their works in Putney—£8000, being 5 per cent. upon such gross outlay. Now, Messrs. Hare and Whitfield know, or ought to know, that they had no right whatever to inquire into the profits of the Chelsea Water-Works Company; because the Act 6 and 7 Guil. IV., cap. 96, expressly provides that the assessment is to be made on "the net annual value," that is to say, "of the rent at which the same might reasonably be expected to let from year to year, *free of all usual tenant's rates, taxes, and tithe commutation rent charge, if any, and deducting thencefrom the probable average cost of repairs, insurance, and other expenses, if any, necessary to maintain them in a state to command such rent.*" The law courts have invariably asserted the principle that *profits* (as profits) are not to be rated; so that the churchwardens clearly exceeded their powers, or rights, in asking for any information on the subject. But when Messrs. Few had, in a somewhat uncourteous manner, neglected to reply to the application of Messrs. Hare and Whitfield, the latter were manifestly exceeding their duty in assessing the company at the rate of 5 per cent. on its total outlay in Putney Parish, without making a single one of the deductions provided by the statute. At any rate, it appears to us that if Messrs. Hare and Co. did not seek to ensure an appeal, they certainly "tried it on" with the company in a manner to render such an appeal inevitable.

In one of the local papers of the commencement of February, 1852, we read a description of the inspection of the works for the Water Supply and Drainage of Rugby, by the Earl of Shaftesbury, Mr. Chadwick, and Dr. Southwood Smith; and after giving some minute details of the works, and some notoriously false statistics of the cost thereof, and of the future rating, in the usual Board of Health style, the description concludes as follows:—"The works have been laid out on a scale to meet a very considerable increase in the size of the place, and it was said that, with a very slight additional expenditure, they would serve for double the present population." Yet in the *Rugby Advertiser*, for April 25, 1857, we find that the Local Board of Health has been obliged to apply to Mr. Hawksley to advise them in respect of the "extension of the sewerage and water supply;" although it is notorious that the increase of Rugby has been far from considerable. The acknowledged failure of the works at Rugby is one of the most striking proofs of the mischievous effects of the Public Health Act, as it was administered by Mr. Chadwick; and certainly it ought to insure an inquiry into the whole system.

We learn that in our remarks upon the conduct of the directors of the Great Central Company, in the matter of justifying to the Common Council the possession of their capital, we included one gentleman in the implied censure, whose conduct certainly entitles him to an earnest apology on our part. We allude to Mr. Bradbury; who, we have now reason to believe, not only willingly accepted the responsibility of the additional shares the directors were compelled to assume, but actually paid for them at once. We shall at all times be happy to apologize thus for any mistake into which we may be led; and, indeed, should be particularly pleased to record any explanation of the transaction, in which Mr. Bradbury bore no part, from his colleagues.

We have just received, too late for us to notice it as it merits, a copy of Mr. Toulmin Smith's second edition of his work upon "The Parish." Its appearance at the present moment is very opportune, or at least it would be so, if our law makers would take the trouble to study the subjects they presume to legislate upon; but, unfortunately, they are not in the habit of so doing, and it is to be feared that Mr. Toulmin Smith's learned researches into the gradual development of our local institutions will not be appreciated until those institutions themselves shall have been sacrificed to the prevalent mania for "continentalizing" or centralizing our administration. We propose hereafter to return to the examination of this valuable addition to the constitutional history of our country; at present, we can only record our admiration for the consistent and earnest spirit with which Mr. Toulmin Smith has fought the good fight of local self-government against bureaucracy, in spite of the indifference even of those who were directly interested in supporting the institutions he has defended for so many years, through evil report and good report; and for the sound learn-

ing and depth of research to be discovered in every page of his book. All who are concerned in parochial matters (and who is not?) ought at once to study carefully "The Parish."

THE AMMONIACAL PRODUCTS OF GAS-WORKS.

In treating the common gas liquor these two questions arise as to the object contemplated: whether the object consists merely in a desire to manufacture the rough and impure salt long known in the market under the designation, sulphate of ammonia, or the more pure article which recent improvements have enabled the manufacturer to introduce in its place. Nor are these questions so easily decided as might at first sight appear: there is such a thing as prejudice, and those who will not bow down to it must submit to console themselves with the reflection of their superior knowledge, and see the pecuniary prize snatched from their grasp by the man who can, not only manufacture to supply the wants of his customer, but also his prejudices. Now some people prefer the old dark salt of the dark ages; it has a fine brown tint, and *looks* stronger than the modern pale-faced variety; and why should such people not be supplied with what they want? Why must they relinquish "brown stout" for "pale ale," merely because science declares that the only difference betwixt the two consists of "burnt sugar?" This is a land of liberty! and therefore we say to those whose customers require the "*brown and strong crystal*," let them have it—and this is the way to make it.

Having placed a given quantity of ammoniacal liquor in any convenient vessel, provided with a tube or exit for the evolved gases either in its cover or in the side near the top, such a quantity of the sulphuric acid, called brown or chamber acid, is to be poured into the gas liquor as by experience, or a previous experiment on the small scale, is known to be sufficient to saturate the ammonia: or, where the gas liquor varies much in strength, the addition of the acid may be continued until the liquor is decidedly acid to litmus paper, when about 2 per cent. of the ammoniacal liquor first used may be added to the whole, and the fluid run out into the evaporating-pan to be evaporated. It may here be necessary to say a word or two about the mixing vessel just alluded to, and which we have described by the term "convenient:" it may be of wood or of any material, and its shape is of no consequence provided it be large enough. At the bottom there must be a cock or hole and plug, and it ought to be placed high enough to cause the fluid in it to flow by mere gravity down to the evaporating-pan. Its cover is the most important object, and should be close-fitting and provided with a tube for the discharge of the carbonic acid and sulphuretted hydrogen gases evolved during the operation, which gases cannot be burnt or passed through a fire, as they extinguish flame thus united. The only safe plan is to send these gases through one or other of the oxide-of-iron preparations, by which the sulphur will be arrested in a manner to satisfy the nosey qualifications of the quacks who now act as "pointers" and "setters" to the great insanitary movement. Having thus got rid of the gases, and saturated the ammonia of the gas liquor with sulphuric acid, we have an impure solution of the sulphate of ammonia to discharge into the evaporating vessel. This solution consists principally of sulphate of ammonia, but contains also muriate of ammonia, derived from the coal and ferrocyanic acid, or ferrocyanate of ammonia, derived from the coal and from contact with the iron of the hydraulic main, &c.; and it also contains sulphurous acid and free sulphur, if the ammoniacal liquor has been long enough exposed to the air to generate hyposulphate of ammonia, which is very frequently the case. It ought to be boiled down, or rather simmered down, in shallow leaden pans, set in similarly-shaped vessels of cast iron; but it may be boiled down in cast-iron pans where contamination with iron is of little consequence (as for the manufacture of manures), but, when wanted to make alum, iron should be rigorously excluded. In either case the evaporation must be carried on to the formation of a thick pellicle, when the liquor may be run out to crystallize, or it may be simmered to dryness with a heat not exceeding 212° Fahr.

To make the *white* salt, the ammoniacal liquor should be run into a common steam-boiler, capable of holding one-third more than the charge; here it is made to boil, and the steam and the ammoniacal vapours are made to pass through a vessel containing common chamber acid, such as we have before alluded to. In passing through the acid, the ammonia is arrested, and forms sulphate of ammonia; but the heat generated by this combination is sufficiently high to prevent the condensation of the steam, which, therefore, passes away with the carbonic acid and sulphuretted hydrogen gases, and, being conducted into an empty flue, assists in arresting these gases when cooled down by contact with the atmosphere; there is, however, a disagreeable smell, and this is not easily got rid of even by the oxide-of-iron process, in consequence of the presence of the steam. As the acid becomes saturated, white granular crystals of the sulphate of ammonia form and fall down in the vessel, and the process is continued until free ammonia passes through the fluid, and thus proves that perfect saturation has occurred, when it becomes requisite to turn the ammoniacal current in another direction. This is done by the arrangement of the apparatus, which for this purpose is made to consist of two sulphate-of-ammonia vessels, one only of which is in use at one time. These vessels may be of wood, lined with lead; and it is advantageous to have the bottom basin-shaped, or hemispherical, so that the sulphate of ammonia may easily find its way to the lower part, and be removed with a scoop. The tube conveying the ammoniacal vapours should be of lead, and descend almost to the bottom of the vessel; and this tube should be arranged with an elbow, so that it may be cleared out in case it becomes obstructed by crystals: the top may be altogether of wood, and provided with a spout for carrying off the non-condensed products into a flue. As has before been said, these vessels are worked alternately; and the salt, when extracted, must be thrown upon a wicker filter to drain for some hours before it is packed for market. The fluid in the boiler soon parts with its ammonia, and seldom requires to be boiled down to more than one-third of its total bulk, when it becomes inodorous, and may be run away, and a fresh charge introduced. There is a trifling loss of ammonia in this way, from the presence of a portion of muriate of ammonia or sal ammoniac in gas liquor, which, however, may be recovered by putting a little milk of lime into the boiler quarter of an hour before the boiling is discontinued; but this is not found practically worth doing. The principal points to be attended to in this system of manufacture are, the complete saturation of the acid before the sulphate-of-ammonia vessel is thrown out of action to have its sulphate extracted, and close attention to the boiler to determine when the evolution of ammonia has practically ceased: this last may be done by the smell.

To obtain the ammonia which *exists in the gas*, no better plan has perhaps ever been suggested than the original method of Mr. Croll, by means of diluted sulphuric acid; something has, indeed, been said against this process on the score of destruction to the apparatus, and the deposit of naphthaline, upon which a remark or two seems necessary. As regards the first, we certainly cannot allow it to weigh much, because, if the acid be contained in proper leaden vessels, the destruction ought to be very trifling; and, if the gas be operated upon as it should be, immediately after it leaves the condenser, nothing can possibly pass through the lime, or other purifying agent in the purifiers, at all injurious to any apparatus. That naphthaline is more liable to be deposited when all the ammonia is taken out than when a portion is left in the gas, seems one of the best established facts in gas manufacturing, though its explanation is not quite so clear; but diluted sulphuric acid will not remove the whole of the ammonia from coal gas; it will not, in fact, remove the whole of the bicarbonate of ammonia, and hence, foul gas, freed from its free ammonia by diluted sulphuric acid, nevertheless exhibits the presence of ammonia after it has passed the dry lime purifiers. It remains, then, to be seen, how far this naphthaline objection is of such force as to outweigh the advantages of so simple a system, and more especially, since the admixture of cannel coal has rendered the deposit of naphthaline of comparatively rare occurrence; we know of one establishment where the gas is purified from its ammonia by diluted sulphuric acid in the above manner, and no complaint of any kind has arisen during the last eighteen months; meanwhile, the sulphate of ammonia thus obtained has sold for £17. 10s. per ton. True, there has been some extra cost for purification, because the impurities which would have been arrested by the ammonia in the scrubber have passed on into the purifier, but this difference has in no way approached the advantages gained on the other side; this matter, then, is well worthy the attention of small country gas-works in particular.

The next best method of securing the ammonia in the gas is unquestionably that now practised with such success by Mr. F. J. Evans, and worked out into detail by Mr. Alfred King, of Liverpool. The theory of this process is as follows: oxide

of iron and sulphate of lime are generated under such circumstances as to ensure perfect admixture, to the exclusion of every form of organic compound, whether sawdust, moss, breeze, or otherwise. This mixture is placed in the purifier and the foul gas passed through it, by which means it is soon converted into sulphuret of iron, sulphate of ammonia, and carbonate of lime. Upon blowing air through this compound, the iron oxidizes with the production of just sufficient heat, to cause the carbonate of lime to re-act upon the sulphate of ammonia and generate sulphate of lime and carbonate of ammonia, which latter escapes with the surplus air, and, being driven through a vessel containing diluted sulphuric acid, there produces sulphate of ammonia; whilst the sulphate of lime and oxide of iron become again fit to act upon another portion of foul gas. In this way, Mr. Evans finds the air from the ventilation of 16 tons of purifying material in one of his 18-feet-square purifiers, at the Westminster station of the Chartered Gas-Works, is capable of saturating about one ton of common chamber acid. Surely, with facts like this before our eyes, it is not asking too much to request that other engineers may "*Go, and do likewise.*"

We shall perhaps be told that, however applicable to the case of large gas-works, our remarks are worthless in respect to small ones, from the expense of the apparatus we have described, compared with the smallness of the produce in any single instance. Now, we very much doubt whether this objection would really hold good in nine-tenths of the gas-works throughout Great Britain; but, taking it at its full value, what does it amount to? Why, simply to this: that a locomotive apparatus must be constructed to work up the ammoniacal products of the very small works at stated intervals, they being provided with receptacles for the storeage of their gas liquor, &c., of such a size as to suit the respective periods of visitation. It is not our province to devise the proper form for such a locomotive apparatus, but surely those who see locomotive thrashing-machines and other agricultural apparatus carried about the country every day for the temporary purpoposes of the farmer, can have no difficulty in conceiving how a mere steam-boiler and two vessels for making sulphate of ammonia may be similarly carried, within a limited circle, from one gas-work to another at stated periods, so as to work up the collective ammoniacal products of the previous three or four months. At all events, the interest of the country at large, no less than that of the gas companies themselves in particular, requires the construction and use of such an apparatus; and the day cannot be far off when the want thus felt will be supplied: we content ourselves, therefore, by pointing out the road which lies open to industrial improvement, and leave the rest to that sterling endowment, the genius of commercial enterprise.

WESTMINSTER GOVERNMENT OFFICES COMPETITION.

It would be in vain here to enter upon the discussion as to the advisability of increasing the powers, and of centralizing the action, of our Administration;—considerations which, after all, are at the bottom of the question of centralizing the Government offices—because, firstly, it would be necessary in such case to examine several grave political questions; and, secondly, because the current of public opinion appears to be setting so fast towards a course which we ourselves believe must eventually lead to the ruin of the nation, that it would be but labour lost to attempt to stem it. Formerly, Englishmen prided themselves upon managing their own business, and upon governing themselves: now, we appear to be blindly following in the wake of the effete nations of the continent; and, being either too lazy, or too cowardly, to support the efforts and the struggles of freedom, we cast upon the State the cares our ancestors felt to be incumbent upon themselves alone. Under such circumstances (that is to say, the range of the duties of the Governmental administration being extended so as to include the education of the young, the health of all, the relief of poverty, and many other functions of private or local corporate bodies), it is, perhaps, a necessity that the army of functioneers, the numerous class of busy idlers who cannot dig, and yet are not ashamed to beg, should be brought closely together in order to prevent the extension of the mischief, and to counteract, as far as possible, the evils they must eventually produce. Yet the exhibition of designs in Westminster Hall ought to make the public think before it lends itself to the course to which our rulers are desirous of engaging it. They who run may read that it is sought to engage the nation in an expensive mania for erecting palaces to receive clerks, whose principal duty will be to study the means "how not to do it:" the good which is to ensue is far more problematical.

Before the judges shall have passed their opinions upon the merits of the various designs, we feel that it would be unfair to say much in praise, or in blame, of any of them; but we may be allowed to call attention to the absurdity of all these so-called anonymous competitions, if it were only for the reason that we ourselves know the names, and could indicate the productions, of thirty-five of the candidates. It is pretty well understood beforehand who are to be the competitors favoured in high quarters; and, with the present organization of the Office of Works, it is a farce to expect justice from it. The majority of the persons who have submitted designs seem to have felt this; for they have cast aside the "instructions," and have evidently worked more with reference to the display of their talents in a public exhibition than to the programme issued by the Board of Works. The first impression, indeed, which we received on visiting the show was, that all the architectural students of Europe had sent in drawings for an academical competition "for Palaces of Administration," and had indulged their fancies regardless of expense, or the more common sense conditions of building offices in which clerks could see to work. On a closer inspection, we discovered that some of the ground plans were more reasonable than we had at first believed, especially that of the design (by a well-known name) under No. 99; but still, even in these cases, the money question has been carefully kept out of sight. It would be a moderate calculation to say that the cost of the most reasonable of these designs would eventually be nearly ten millions sterling, without taking into account the alterations in the approach roads. Is the nation prepared for this? Are the provinces willing to be taxed to this extent for the beautification of the metropolis? or for housing a body of useless drones?

We looked at the drawings in Westminster Hall with some attention, in order to discover the prevailing impression amongst architects with respect to Westminster Bridge; and we dwell upon it, for the consideration of that question is not likely to prejudice the decision as to the merits of the architectural designs. Possibly some of the competitors were induced to pass lightly over this portion of the subject, because they felt or imagined that Government were not likely to sanction any further waste of money by an alteration of the site of the bridge; but it is certain that a considerable majority of the designs submitted are in favour of retaining this communication between the banks of the Thames in its present position. Amongst the authors of the total number of designs, 217 in all, about 75 avoid any allusion to the position of the bridge; of the remaining 142, no less than 73, or more than half, propose to retain it where it now is, whilst 18 propose to move it 100 feet (an alteration for the mere sake of an alteration), 32 propose to move it between 150 and 600 feet, 12 propose to isolate the administrative quarter altogether, and the remainder suggest alterations of various descriptions hardly worthy of notice. In face of a verdict so strong, and after the examination of the select committee of last year into the scientific principles adopted in the construction of the new Westminster Bridge, what pretext can remain for wasting money upon its removal, or for leaving the communications between Westminster and Lambeth in their present dangerous and unsatisfactory state? Any one who is able to judge of these matters must be convinced, from an inspection of the large model map of this part of London, made at the expense of Mr. Roupel, M.P. for Lambeth, that even if the ground on the south side of the river had been entirely unoccupied, it would have been injudicious to place the bridge at any sensible distance from where it now stands; with all the complicated interests which have been created by a leading thoroughfare during so many years, it would be little more than reckless injustice to disturb existing relations for the sake of a small theoretical advantage. But these considerations of justice and common sense do not weigh with passionate, despotic liberals: so we should be prepared to hear that the removal of the Westminster Bridge will form one of the recommendations of the design to be crowned by official favour, had we not great confidence in the tribunal to which the designs are referred.

Apart from the vulgar considerations of economy, we would, however, observe, that the designs in Westminster Hall exhibit very marked traces of the improvement in architectural taste

which has come over us since 1830. There is much genius, much imagination and artistic feeling in many of them, and an earnest striving after the truthful representation in stone and brick of the thoughts and feelings of the age we live in. It is true that there are some questionable imitations and revivals of obsolete and foreign styles, and some designs which would be of surpassing merit if they were only intended for other climates, or other purposes than for our Government offices. But, as a whole, the exhibition is highly creditable to the English architects, although we fear—nay, rather hope—that their labours may be rendered useless by the refusal of Parliament to enter upon an expensive mania for building, of which no one can count the cost.

It is impossible to conclude this notice without calling the attention of our readers to one singularly incorrect statement upon the subject made by the *Observer*—a journal known to be written under the direct auspices of the First Commissioner of Works. It was stated in one of the last numbers of that paper, that the majority of the designs for the new offices suggested the removal of Westminster Bridge. What the truth is upon that subject any one can now see; but what was the object of publishing this little distortion of fact? What can have been the excuse for such a paper's stating that Lord Stanhope is President of the Royal College of Architects, when no such body exists, and when it is notorious that Earl de Grey is President of the Institute of British Architects? There is a report that David Roberts has declined to act upon the tribunal to decide on the merits of the designs. We hope sincerely that this is not the case.

Circular to Gas Companies.

We publish in another column an instructive document in the shape of the balance-sheet of the 26 months' operations of the Sheffield Consumers' Gas Company, a speculation in which Mr. Flintoff induced the Sheffield public to embark and incur obligations exceeding £50,000 in amount. This document proves that the sale of about 14½ million cubic feet of gas at 3s., and 18½ million feet at 4s. per 1000 feet, resulted in an average loss of nearly 11½d. per 1000 feet, exclusive of interest on capital; and this, too, in a coal-producing county, and in a position where the best gas coals can be delivered into the works at 9s, per ton. This peripatetic individual has recently located himself in Dublin, and has there issued a statement in which he attempts to prove that the citizens of the sister metropolis may be supplied with gas at 3s. 3½d. per 1000 feet, with a profit of 10 per cent. upon the capital employed, the price of coals being assumed to be 17s. 6d. per ton. It remains to be seen whether the gas consumers of Dublin will profit by the experience of their brethren in Sheffield, and we recommend them to examine how far Mr. Flintoff's theoretical estimates have been verified by the test of experience, before they commit themselves to any experiment of their own. We may add, that the loss at Sheffield was really greater than is shown by the accounts, as during the six months preceding the handing over of the works to the old company no repairs of any importance had been executed, and in the final settlement a large sum was charged to the Consumers' Company on this head.

The Rochdale Improvement Commissioners, who are also the owners and occupiers of the gas-works in that town, have recently appealed against an increase in the rate imposed upon them by the overseers of one of the townships in which their works and a large portion of the pipes are situated. The old rate was £1200 per annum, and this, upon the strength of large additions having been recently made to the works, was increased to £1800. The matter was referred to Mr. Monk, the barrister of the northern circuit, who has just made his award, reducing the rate to £1648. 9s. 9d., a sum largely in excess of the value of the property if the same principle were adopted as that upon which mills and other similar property in Rochdale are rated; but in the present state of the law there appears to be absolutely no relief to the owners of gas-works from such unjust and unequal taxation.

Mr. Broadbent has commenced a second action against the Imperial Gas Company for alleged damage sustained by his fruit trees since the commencement of the previous action: the unlooked for bursting into leaf of trees asserted to be dead has, however, caused the proceedings to be, for the present, suspended, as it is more than probable that the long continued easterly winds and consequent cold weather have exercised a greater influence in retarding vegetation in the vicinity of the Fulham Gas-Works than the alleged noxious exhalations from the works themselves. The pugnacious market-gardener has doubtless by this time ascertained that his own fruit trees are greener than the Imperial Gas Company has proved itself to be; and it is to be hoped that all future attempts to extort unreasonable compensation will cease, now that the company has complied with the injunction of the Court of Chancery, and suspended the manufacture of gas in that portion of their works abutting on Mr. Broadbent's grounds.

Correspondence.

THE CHELSEA WATER-WORKS AND THE PARISH OF PUTNEY.

Sir,—It was only this morning that our attention as solicitors to the parish of Putney was called to a leading article in your useful paper of the 14th inst., in which you make the following statement:—"The rating case between the parish of Putney and the Chelsea Water-Works Company is one of the most monstrous instances of extortion we have lately heard of. The parish authorities coolly asked to fix the rateable value of the company's works at £8000 a year, no doubt in order to ensure an appeal, which would enable their law officers to make a good bill of costs," &c.

As the conclusion come to by you is not the correct one, and not justified by the circumstances, we think it our duty to put the overseers of Putney right with your readers.

1. The overseers considered that the proper mode would be to assess the company upon such a proportionate sum of profit as the works in Putney were instrumental in producing, after making a deduction for the proportionate working expenses of the undertaking.

2. They consequently applied to the company, before the rate was made, for a particular of receipts and expenses, to enable them to arrive at a just conclusion, which the company declined to give, and, indeed, to give them the least information upon the subject.

The overseers were then driven to the necessity of judging for themselves what the fair rateable value should be; and the only test they were enabled to adopt was to take a per centage upon the outlay expended by the company in the erection of their works in Putney—£8000—being 5 per cent. upon such gross outlay. This large figure would not have been fixed upon, if the company had shown the least disposition to assist the parish in arriving at a just conclusion.

The following letter, written to the company's solicitors by us, shows no desire on the part of the overseers or the parish to act otherwise than fairly:—

Temple, Feb. 9, 1857.

Dear Sirs,—It is not shown yet that your clients are over-rated. If you would show by satisfactory evidence that the company should not pay upon so much as the rateable value fixed by the overseers, they would do what was fair under the circumstances; but you have refused to show the company's books, or otherwise to give information, which might lead to a just conclusion of what the assessment upon the company's works should be. Our clients, therefore, have no alternative but to rate the company upon the sum they have estimated to be a fair rateable value. The overseers, therefore, do not think you should appeal, but that the rate should be paid without delay.

Yours faithfully,

Messrs. Few & Co. Hare & Whitfield.

The very stringent remarks made use of by you have made it necessary for us to trouble you with this communication.

Temple, April 29, 1857. Hare & Whitfield.

Register of New Patents.

2511.—George Henry Bachhoffner, of Upper Montague Street, London, Doctor of Physics, for "*Improvements in glass shades for gas and other artificial lights.*" Patent dated Oct. 25, 1856.

This invention of improvements in glass shades for gas and other artificial lights relates, first, to those globes or shades placed over gas and other artificial lights, which are usually ground or otherwise ornamented. These shades have hitherto been sustained and fixed by a gallery or other support placed underneath. Shades so held have an opening at the bottom with a lip, by which they are clipped or held; which lip, together with the gallery or holder, cast a shadow and obstruct the passage of the rays of light in the direction required.

Now these improvements consist in forming the shade with the opening for the introduction of the gas-pipe at the side, so that the pipe enters in a horizontal direction. The air to sustain combustion is admitted at the side where the pipe enters, or a supply may be admitted by a small hole in the bottom of the shade. The glass shade is also supported from the side, and is therefore without any obstruction to the transmission of the light through the bottom of the shade, which may be quite closed, and of a plain or ornamental character, as required. These glass shades are sometimes constructed with the lower part formed to deflect the rays of light in the manner of a lens or lenses. The upper part of these shades is open as usual.

The second part of this invention relates to shades for night-lights or other lights. It consists in placing the lights within two glasses as follows:—First, a short glass shade or chimney, supported from the bottom in a gallery or holder having small perforations for the admission of air: the second and large glass shade encloses the inner one, which outer shade is closed at the upper part, but is furnished with perforations in its holder or gallery for the escape of the hot and vitiated air at the bottom. The

air, therefore, passes first up within the inner glass to supply combustion, and, escaping into the dome of the outer glass, is conducted down and out of the lower part thereof, thus preventing the possibility of anything catching fire from lights so enclosed.

The claim is for—

1. The formation of glass shades for gas and other artificial lights, in the manner and as hereinbefore described with reference to figs. 1, 2, 3, and 5 of the drawings; also for the formation of lenses in such glass shades, as hereinbefore described; and,

2. For the arranging and combining two glass shades with a lamp or candle, as hereinbefore described with reference to figs. 6, 7, and 8 in the drawings.

2583.—JOHN KIRKHAM, of Tonbridge Place, New Road, London, engineer, for "*Improvements in the construction of furnaces, ovens, or kilns for drying, baking, or burning pottery, earthenware, bricks, tiles, or other similar articles; and in the means of collecting and condensing the smoke, gases, or vapours, evolved from the fuel in such or other furnaces or fire-places, or that escapes from the retorts and other parts of the apparatus used in the manufacture of gas.*" Provisional protection only obtained. Dated Nov. 3, 1856.

These improvements relate, in the first place, to an improved mode of constructing the furnaces, ovens, or kilns, for the above-named purpose; and, second, to a means of collecting and condensing smoke and gases or vapours, which means is not only applicable to the furnaces above referred to, but also to all furnaces, retorts, or apparatus from which such gases may be evolved.

In carrying out the first part of the invention, the furnace or oven should be built with brickwork, and the crown or top arched over or otherwise made close and air tight, and the internal capacity constructed in a suitable manner for the quantity of material required to be burnt at any one time, for which purpose one, two, or more fire-places may be constructed in the bottom part of the oven; and air is admitted over the top of the fuel, from the sides or ends of the furnaces, to assist the combustion of the gases evolved therefrom.

The flame and heat circulates through the oven, and is then drawn down and through descending and horizontal flues constructed in the bottom of the oven, and from thence is carried through a second, third, or more ovens, whereby the spare heat may be beneficially employed in drying and preparing the articles or wares to be next burnt.

The heat and gaseous vapours are drawn, as before described, through the ovens and flues, so that as much as possible of the heat may be used and economized. The vapours are then conducted through close condensing-vessels, containing pebble-stones or other suitable materials for increasing the contact surfaces. The vapours are drawn by fans or other machinery suitable for such purpose, and water is injected in and amongst the pebble-stones contained in the condensing-vessels, whereby the gaseous vapours, in passing through the condensing-vessels, will be condensed and absorbed by the water.

The second part of the invention—that for collecting and condensing the gases and vapours as above described—is also applicable to all ordinary furnaces, from which smoke and gases will be prevented from issuing by exhausting from the flues of the furnaces, and collecting and condensing all such gases and vapours produced either by heat, or distillation, or combustion of coal, coke, tar, or any other substances, as well as the gases and vapours arising from decomposition or from any other cause.

This part of the invention is also applicable to the exhausting, collecting, and condensing of all gases and vapours arising from any fuel used for heating any or all kinds of boilers, coke ovens, kilns, glass-house furnaces, retorts, and retort-houses, or other distilling or heating apparatus, or any furnaces whatsoever. Also for the ventilating by exhausting, collecting, and condensing the smoke and gaseous vapours produced in retort-houses, purifying houses of gas-works, or any other buildings requiring ventilating, and which gases would otherwise escape into the atmosphere.

In order to more fully describe the invention as applicable to ventilating retort-houses, or any other buildings, the inventor observes that he causes the roofs and upper windows or openings in walls to be closed and made air-tight. The fresh atmospheric air will flow into the building by the lower windows, doorways, or other openings, and press the smoke and all other gaseous vapours upwards under the roof, from whence the smoke and vapours are drawn down through pipes, trunks, or brick shafts, either of which is carried up under the roof to within a suitable distance from the upper part, and the top of such pipes or trunks is to be opened out into a hopper or bell-mouthed shape. The smoke and gaseous vapours are drawn down, and through pipes or other channels to and through the close condensing chamber or chambers above described by a revolving fan, or other suitable exhausting machine, the smoke and gaseous vapours being drawn into the condensing chamber is there condensed and absorbed by water as before described.

2597.—JAMES FERNIHOUGH, of Dukinfield, in the co. of Chester, boiler-maker and ironfounder; and ROBERT FARROW, of Leek, in Staffordshire, engineer, for "*A self-acting apparatus for regulating the supply of atmospheric air to furnaces, gas stoves, and other closed vessels used for the consumption of fuel or combustible gases, by preventing the formation of smoke therefrom, and thereby economizing such fuel or combustible gases.*" Patent dated Nov. 5, 1856.

This invention consists in admitting into and shutting off from any desired part of furnaces, flues, gas stoves, or other vessels used for the consumption of fuel or combustible gases, a supply of atmospheric air, by means of a series of valves or flaps, the opening and closing of which are caused by the external pressure of the air. The regulating varies either more or less in proportion to the amount of burning fuel or gases, and the expanded products arising therefrom within the furnaces, flues, gas stoves, or other vessels. Each of the said valves consists of a plate of any suitable metal or material, having a pivot or centre at each end, and supported in a frame with transverse bars or plates, which form the seatings or surfaces for one of the edges of the valves to impinge upon, so as to close the passages, and also form one side of the opening for the admission of air. The valves are weighted in any convenient manner, and are perfectly self-acting, opening freely by the pressure of the atmosphere at any requisite angle. The difference in the amount or quantity of the air, and the space of the opening, depend, as already stated, on the intensity of the heat within the furnace or chamber; and rows of vertical bars are set at the back of the door to shield the valves in the front from the action of the fire, and divide the air into thin streams.

To adjust the valves the fire is allowed to burn down until no combustible gases are given off; the valve-weights are then adjusted, so as to allow the valves to close of themselves. Upon the introduction of a fresh charge of coals the valves open just in proportion to the amount of combustible gases generated, and again resume their former closed position as soon as the fire has burnt down to the same state as that at which they were set. It is evident that this action is natural, caused partly by the chemical affinity that exists between highly heated hydrogen and oxygen, and partly by the additional draught created by converting the combustible gases into flame instead of smoke. These valves may be applied in any desired form or shape, and to any part of a furnace or flue, but they are preferred to be placed in the furnace door.

The claim is for the use of self-acting valves or flaps, the opening and closing of which are caused by the external pressure of the air, thus admitting into furnaces, stoves, &c., where fuel is consumed, a supply of atmospheric air, and shutting off the same for the purpose of forming a more perfect combustion of the gases, and thereby preventing the formation of smoke, as such apparatus is herein described.

PROVISIONAL PROTECTION

HAS BEEN GRANTED FOR THE UNDERMENTIONED PATENTS.

882.—JEAN EUGÈNE D'ARCET, of Paris, chemist, for "*Improvements in distilling and rectifying tar, resin, oils, turpentine, bitumen, and other matters, and in the apparatus for the same.*" March 31, 1857.

888.—FRANK CLARKE HILLS, of Deptford, in the co. of Kent, manufacturing chemist, for "*Improvements in manufacturing gas, and in apparatus connected therewith.*" March 31, 1857.

992.—JASPER WHEELER ROGERS, of Peat House, Roberts Town, in the co. of Kildare, engineer, for "*Improved means of, and apparatus for, collecting for use the excrement of towns and villages, and for facilitating the drainage of houses generally.*" April 8, 1857.

1060.—WILLIAM EDWARD NEWTON, of 66, Chancery Lane, London, civil engineer, for "*Improved means of lighting gas for illuminating and other purposes.*" April 14, 1857.

1089.—SAMUEL MESSENGER, of the firm of Messenger and Sons, gas-fitting manufacturers, Broad Street, Birmingham, and Hatton Garden, London, and THEODORE FLETCHER, also of Birmingham, superintendent of works at the Birmingham establishment, for "*Certain improvements in gas-burners.*" April 18, 1857.

1179.—AMABLE VICTOR FELIX LARCHIER, gentleman, of Paris, for "*Improvements in the manufacture of gas.*" April 27, 1857.

NOTICES HAVE BEEN GIVEN OF INTENTION TO PROCEED WITH THE UNDERMENTIONED PATENTS.

3081.—WILLIAM SWAIN, of Birmingham, engineer, for "*Improvements in heating and ventilating.*" Dec. 27, 1856.

871.—JOHN JAMES RUSSELL, of Wednesbury, in the co. of Stafford, metal tube manufacturer, for "*Improvements in the manufacture of metal tubes.*" March 28, 1857.

888.—FRANK CLARKE HILLS, of Deptford, in the co. of Kent, manufacturing chemist, for "*Improvements in manufacturing gas, and in apparatus connected therewith.*" March 31, 1857.

Legal Intelligence.

COURT OF EXCHEQUER.

MAY 2, 1857.

(Sittings *in Banco* before the LORD CHIEF BARON, and Barons MARTIN, BRAMWELL, and CHANNELL.)

BOOTH *v.* KENNARD.

THE VEGETABLE GAS PATENTS

In this case, which was argued during the present term, the court gave judgment as follows:—This is an application to set aside the verdict for the defendant, and to enter a verdict for the plaintiff, damages 1s. The action was brought for the infringement of two patents: the first, dated November 12, 1850, entitled "An invention for improvements in the manufacture of gas;" the second, May 8, 1852, having the same title. There were the usual pleas of not guilty, that the invention was not new, and so on. At the trial general evidence was given to entitle the plaintiff to recover in respect of the second patent as to novelty and utility; but, on the part of the defendant, evidence was given of several patents and specifications which had been enrolled prior to the plaintiff's patent, and of one publication, namely, "Parke's Chemical Essays," published in 1823. The plaintiff's second patent was described in the specification to consist of "the direct use of seeds, leaves, flowers, beech nuts, fruit, and other substances and matters containing oil or oily or oleaginous matter;" and the mode of using the material, it was said, might be the same as the apparatus used in the ordinary mode of making gas from coal. The claim was in these words: "I claim the making of gas from seeds and matter herein named for practical illumination or other useful purposes, instead of making it from the oils, resins, or gums previously extracted from such substances." On the part of the defendant, a patent, granted to a Mr. Edward Heard on February 12, 1829, with a specification, was given in evidence. The inventor by his specification proposed to use fatty substances, such as grease or resin—the residuum, after the oil had been pressed from the seeds, such as oil cake, also beech nuts, cocoa nuts, and other matters abounding in oil; and he proposed to use these substances separately. He also gave in evidence a passage from "Parke's Chemical Essays," which, it was admitted, had been generally circulated in this country before the date of the plaintiff's patent; but, for the reason given presently, it is not necessary to cite the passage from "Parke's Essays." At the trial, the Chief Baron thought that Heard's patent and specification, which expressly named beech nuts and cocoa nuts, and referred to oily and fatty substances, and also the publication of "Parke's Chemical Essays," had anticipated the plaintiff's discovery as to the making of gas direct from substances containing fatty and oily matter, such as seed, &c.; and he directed the jury, if they believed the evidence, to find a verdict for the defendant, reserving the point, by the consent of the parties, for the opinion of the court who were to decide, and, if they thought fit, enter a

verdict for the plaintiff damages one shilling, if they thought the plaintiff entitled to the verdict. He also decided that, the claim in the second patent being merely for making gas direct from seeds and matters stated in the specification, without any reference to any mode of doing it, was too large and general a claim, and could not be supported. The jury, accordingly, found a verdict for the defendant on the two issues as to novelty and the goodness of the specification; and the question we have to decide is, whether the direction given at the trial was wrong, and whether the verdict ought to be entered for the plaintiff damages one shilling. The case had been tried on a former occasion, when a bill of exceptions was tendered to the ruling of the Chief Baron, which was argued in the Exchequer Chamber, and a *venire de novo* awarded. On looking at that case, it appears to me that the Court of Exchequer Chamber merely decided that the invention of making gas direct from seed, or other oily or fatty matters, was one which, if new (and in that case it was assumed to be new), might be the subject of a patent, if properly specified. But they gave no judgment, nor even an opinion, on the question now before the court—namely, first, whether, assuming it to be new and that no one had ever before obtained gas direct from seeds or oily matters, the specification enrolled is a good specification; or, secondly, whether, with reference to Heard's specification, the invention was new. Heard's patent and specification were not before the court of error at all, not having been given in evidence on the former trial. We entirely concur in the decision of the Court of Exchequer Chamber as we understand it. We think that the specification is a document which ascertained the nature of the invention and the manner of performing it, and that the plaintiff by his specification claims generally the invention of making gas direct from oily substances, without obtaining the oil previously, and then making it from the oil; and he claims to do this without reference to any mode of doing it, but, generally, as doing it. We think that Heard's specification clearly shows that, as a general fact—namely, making gas direct from seed and other oily matters—the invention was not new. It is decided in *Bush v. Fox*, 5th House of Lords Cases, page 707, that, when a want of novelty appeared distinctly in a document or written instrument, such as a prior patent and specification, it was for the court to take notice of the identity of the two supposed inventions, and the want of novelty therefore in the second. That Heard had described to the world, and had communicated to the world, that gas might be made direct from nuts and other oily and fatty substances, appears to us to be quite clear from this specification as enrolled. We think it was not necessary to submit this to the jury, and take their opinion upon it. We think that is the plain meaning of the written document, and we think it is for the court to construe it; and this is a part of the invention claimed by the plaintiff in his second patent. We think the plaintiff's invention so far not new; and therefore the invention, as a whole, cannot be claimed as a new one. We are also of opinion that the claim is too large, and that such a claim cannot be supported. It is a claim to make gas direct from seeds, not in any mode pointed out in the specification, but generally. After the publication of Heard's specification, no patent could be taken out for the process generally, although a patent might be taken out for a new particular mode of doing it. We think the plaintiff's second patent was not for any particular mode of doing it, but for the doing it by any mode; and we think that, even if it had been new—as it turns out not to be—such a mode of specifying the invention cannot be sustained as a good specification. We are, therefore, of opinion that the verdict for the defendant ought to stand, and that the rule to set it aside and enter it for the plaintiff, damages one shilling, must be discharged. We have not in our judgment taken any notice of the publication in "Parke's Essays." It was contended that the judge at the trial could not decide upon that, but ought to have left it to the jury. We think it unnecessary to express any opinion upon this point. We think that the construction of the effect of Heard's specification is clearly for the judge and the court. As that shows to our minds most satisfactorily that the invention, as claimed by the plaintiff, is, in part at least, not new, we discharge the rule on that ground, without any reference to the publication in "Parke's Essays."

Miscellaneous News.

BALANCE-SHEET OF THE SHEFFIELD CONSUMERS' GAS COMPANY.

Showing the Expenditure and Revenue from May 1, 1853, *to June* 30, 1855, *the price of gas being* 3*s. per* 1000 *feet for the first fourteen months and* 4*s. for the last twelve months.*

Dr.	June 30, 1854.			*Cr.*	June 30, 1854.		
To coal	£2,095	15	0	By coke	£286	13	5
Lime	143	1	1½	Tar	61	10	3½
Repairs of works	117	1	11½	Waste lime	1	17	10
Wages to stokers and purifiers	551	5	6	Gas rents, at 3s. per 1000 feet	2,179	19	4
Engine tenter's wages	125	12	2½	Balance	1,557	17	3½
Wages to smith and labourers	210	0	7				
Salaries	362	18	2				
Incidentals	46	12	1				
Stationery	83	1	11				
Rent and taxes	344	19	7½				
Commission	7	10	0				
	£4,087	18	2		£4,087	18	2
Balance	£1,557	17	3½	Balance	£1,889	10	0½
Gasholder repairs	331	12	9				
	£1,889	10	0½		£1,889	10	0½

Dr.	December 31, 1854.			*Cr.*	December 31, 1854.		
To balance	£1,889	10	0½	By coke	£198	13	3
Coal	952	19	8	Tar	89	18	5
Lime	36	17	11	Waste lime	13	1	5
Repairs of works	386	2	4	Gas rents, at 4s. per 1000 feet	2,024	19	5
Wages to stokers and purifiers	231	11	8	Balance	1,904	10	3½
Engine tenter's wages	64	1	9				
Wages to smith and labourers	128	4	11				
Salaries	215	13	11				
Incidentals	25	9	10½				
Stationery	11	11	2				
Rent and taxes	279	9	6½				
Commission	9	10	0				
	£4,231	2	9½		£4,231	2	9½

Dr.	June 30, 1855.			*Cr.*	June 30, 1855.		
To balance	£1,904	10	3½	By coke	£124	2	7
Coals	644	15	0	Tar	48	14	0
Lime	23	13	8	Waste lime	5	13	1
Repairs of works	60	19	1	Ammoniacal liquor	13	14	0
Wages to stokers and purifiers	185	17	1	Gas rents, at 4s. per 1000 feet	1,712	6	0
Engine tenter's wages	41	1	1	Balance	1,596	3	4
Wages to smith and labourers	83	0	1				
Salaries	310	10	6				
Incidentals	39	1	1½				
Stationery	15	7	7				
Rent and taxes	193	17	6				
	£3,502	13	0		£3,502	13	0
Balance of loss in twenty-six months	£1,596	3	4				

CHARTERED GAS COMPANY.

The Ordinary Half-Yearly General Court of Proprietors of this Company was held on Friday, the 2nd of May, at the Company's Works, Horseferry Road, Westminster—Benjamin Hawes, Esq., the Governor, in the chair.

The Secretary commenced the proceedings by reading the advertisement convening the meeting, and also the minutes of the last general court, which were approved as correctly entered.

The following report and statement of accounts were then presented:—

Gentlemen,—The accounts of the company, as balanced to Christmas last, and certified by your auditors with their usual care, are annexed; and your directors offer to you such additional information as their vigilant attention to your interests qualifies them to give.

The new gasholder in Holywell Street, we are happy to say, is now in full action.

The profit of this half year, compared with that of 1855, is less by about £900: this has been occasioned, partly by the increased cost of coals (especially Boghead, for which a much larger demand has of late arisen), and the continued unproductiveness of coke, on which alone the decrease in value amounts to £3000. Apart from these casual influences, the profit would have considerably exceeded that of the same period in 1855.

The charge for wear and tear and carrying on of works has increased, from the necessity of altering the position and enlarging the capacity of the mains in Clerkenwell, where the formation of Victoria Street and the alteration of the levels in Ray Street, have alone involved an outlay of £1400.

Such investments, however requisite, cannot prove immediately productive, but their beneficial effect will speedily appear; and meanwhile the balance of profit being £17,025. 1s. 11d., your court of directors feel justified in submitting for your approval a dividend at the rate of £6 per centum per annum upon the amount of capital as it now stands, and free from income tax.

For the greater convenience of proprietors, especially those resident abroad, your directors have prepared a form authorising the payment of dividends to their bankers and agents, without the expense of powers of attorney.

Your directors conclude by remarking that, notwithstanding temporary hindrances, the progress of your concern indicates its solidity. It is an essential public institution—the earliest of its kind—and needs only constant watchfulness to secure its growth and permanence.

The following vacancies in the court of directors, occurring by efflux of time, viz., John Sloper, Esq., and Frederic Albert Winsor, Esq. (both of whom are eligible to be re-elected), will be filled up at a special court of proprietors, to be holden in pursuance of the Act of Parliament, between the 24th of May and the 24th of June next—viz., on Friday, the 5th day of June next, at twelve o'clock precisely—at the company's station, Horseferry Road, Westminster.

Dr. PROFIT AND LOSS, FROM JUNE 24 TO DECEMBER 25, 1856. *Cr.*

To coals consumed in the half year, including labour				£49,372	18	11	By rental of light for the half year	£87,042 16 2
Stores, &c., used, viz.:—							Coke and breeze, deducting labour	16,183 11 1
Retorts and setting, including labour				3,896	16	4	Tar and other products, do.	2,170 8 0
Lamps and lamplighting, do.				1,764	5	9	Discounts and abatements allowed by tradesmen for cash payments	1,355 8 11
Carrying on the works				3,823	9	11	Poplar station rent account, balance	11 13 4
General wear and tear and mains, including labour	£10,353	11	3				Rents received	281 8 11
Less received for old and burnt stores	641	18	4				Dividend on amount in the contingent-fund—viz., on £7601. 7s. 2d. Reduced Three per Cent. Annuities	106 8 4
				9,711	12	11	Interest on deposits at banks	363 3 2
Meters and fixing, including labour				3,137	11	11	Premium on shares re-sold	1,765 0 0
Paving				1,090	0	4		
Directors and auditors				1,233	15	0		
Salaries and commissions				4,118	5	0		
Wages and contingencies				9,576	17	3		
Rent and taxes				2,133	14	2		
Income-tax				791	11	1		
Law expenses				303	17	10		
Annuity to Mr. John Evans, late superintendent	£100	0	0					
Do. to Mr. J. Cowell, late accountant	65	0	0					
				165	0	0		
Sick and benevolent fund				130	0	0		
Debts due at the stations, being bad written off	£1,009	13	4					
Received on bad debts	24	12	11					
				985	0	5		
				£92,234	16	10		
Balance				17,025	1	11		
				£109,259	18	9		£109,259 18 9

Dr. BALANCE-SHEET, DECEMBER 25, 1856. *Cr.*

To amount of 1st, 2nd, and 3rd capitals, at Midsummer			£529,050	0	0		By amount due to the company, viz.:—			
Amount of 1st capital upon shares re-sold this half year			22,450	0	0		For rent of light at the several stations, viz.:—			
						£551,500 0 0	At Westminster station	£42,572	14	8
Amount of 4th capital, at Midsummer			£51,640	0	0		At Brick Lane do.	22,764	9	5
Amount of 4th capital upon shares re-sold this half year			8,360	0	0		At Curtain Road do.	8,919	1	1
						60,000 0 0				£74,256 5 2
						£611,500 0 0	For coke and breeze sold at the stations, viz.:—			
Expended, viz.:—							At Westminster station	£1,305	13	7
Westminster station—							At Brick Lane do.	1,596	5	7
Balance at Midsummer	£319,476	0	0				At Curtain Road do.	231	19	0
Expended this half year	£9,808	0	0							3,133 18 2
Proportion of £8252. 12s. 5d. transferred from new works account chargeable to this station	5,149	1	1				For tar and other products sold at the stations			453 2 1
			14,957	1	1		Amount of the balances of sundry accounts due to the company			2,495 4 0
			£334,433	1	1		Treasurer's accounts, viz.:—			
Brick Lane station—							Balance of general account	£8,119	2	8
Balance at Midsummer	£144,912	19	11				Do. dividend	64	17	0
Expended this half year	£1,973	4	9							8,183 19 8
Proportion of £8252. 12s. 5d. transferred from new works account chargeable to this station	2,817	14	7				Bills on hand not paid			148 5 11
			4,790	19	4		Cash advanced to pay wages at stations			910 0 0
			149,703	19	3		Stores on hand, viz.:—			
Curtain Road station—							At Westminster station	£4,572	19	7
Balance at Midsummer	£62,298	15	10				At Brick Lane do.	3,230	11	1
Expended this half year	£ 13	4	7							7,803 10 8
Proportion of £8252. 12s. 5d. transferred from new works account chargeable to this station	285	16	9				Coals on hand, viz.:—			
			299	1	4		At Westminster station	£3,785	19	4
			62,597	17	2		At Brick Lane do.	1,864	1	11
						546,734 17 6	At Curtain Road do.	756	6	2
						£64,765 2 6	On shipboard	2,717	6	5
Amount of dividends remaining unpaid						5,487 16 0				9,123 13 10
Amount of debts due by the company for coals, and to sundry tradesmen and others						10,316 10 9	Coke and breeze on hand, viz.:—			
Amount due to collectors for commission, viz.:—							At Westminster station	318	12	6
At Westminster station			£263	7	11		At Brick Lane do.	128	7	11
At Brick Lane do.			106	14	0		At Curtain Road do.	65	5	10
At Curtain Road do.			48	1	0					512 6 3
						418 2 11	Tar and other products on hand			843 16 2
Amount due for wages and contingencies, viz.:—							Ship *Dispatch*			1,027 1 3
At Westminster station			£1,024	13	9		London and Westminster Bank			5,000 0 0
At Brick Lane do.			628	5	8					
At Curtain Road do.			246	19	2					
						1,899 18 7				
Amount due at the chief office for contingencies						17 14 8				
Balance of profit and loss, viz.:—										
Balance to June 24, 1856	£23,315	0	1							
Less half year's dividend on £580,690	20,324	3	0							
			£2,990	17	1					
Profit of the half year ending December 25, 1856	17,025	1	11							
			17,969	18	9					
The contingent-fund						20,015 19 0				
Invested in the purchase of £7601. 7s. 2d. Reduced Three per Cent. Annuities			7,000	0	0					
						10,969 18 9				
						£113,891 3 2				£113,891 3 2

The CHAIRMAN moved, without any remarks, "That this meeting do agree with and confirm the report of the court of directors, and the auditors' report and statement of the accounts of the company so transmitted."

Mr. RHODES seconded the motion.

On the question being put,

Mr. JOSEPH BOX rose and said: I think this is a very important question, and requires some observations. They will not, however, be many from me.

The CHAIRMAN: Does it require any?

Mr. BOX: We shall see whether it does or not: I think it does. In the first place, you are about to declare a dividend of 6 per cent. upon the present capital. Now, what is the present capital?

The CHAIRMAN: You have the accounts in your hands, and can see for yourself.

Mr. BOX: Yes; I did not ask for information, but by way of introduction. Your present capital is £611,500; and what I want to ask is, have you enough profits out of the past half year's workings to pay 6 per cent. upon that? I say you have not, but are minus £1320. I know very well that you have a surplus profit from former periods to fall back upon, and that that surplus profit is £2990; but then what a hole you will make in it! And that is not all. The amount you have in the past half year's account to help you in making up the dividend arose in part from the premiums on shares re-sold—viz., £1765. Had it not been for this you would not have had enough for a 5½ per cent. dividend. There is, however, one point to be taken into consideration. The accounts, as they appear before us to-day, are in a much better form than they have been in many previous half years. You have divested them of that feature which I have often spoken about—viz., the carrying of new works to revenue, by which you always brought out a false balance every half year. That is now altered, and the several amounts expended are charged in the general balance-sheet, and divided between the stations. The balance was £8000 odd, but that is now divided, and you have to pay dividend upon an increased capital of £32,000. That, remember, is for ever; it is not a temporary matter, and it probably will be still further increased in amount. Your rental, however, does not seem to increase in the same proportion as your capital does. I complain now that you have withheld from me a great deal of information which I had previously had from the office during the last eleven years and a half.

The CHAIRMAN: You have told us that at the last two meetings.

Mr. BOX: And yet you continue to do it. (Laughter.)

The CHAIRMAN: I say again, I will give you no information which I would refuse to any one else. (Hear, hear.)

Mr. BOX: I have not had a statement of the coals used at the several stations.

The CHAIRMAN: Here it is upon the table.

Mr. BOX: But in the paper I hold in my hands I have only the total rental for the three stations, and therefore I cannot tell which is worked badly and which not. I can, however, guess pretty well. I know what you got per 1000 for gas: it was 4s. 3½d. during the last half year. You have received for premiums on shares £1765, and I know that gentlemen have gone into the market and bought them for less than you have issued them at. I say that is the cause of your swelling the profit and loss account, but it is an item which will not appear again.

The CHAIRMAN: Are you going to make a motion?

Mr. BOX: I see there is an item, "Interest on deposits at bank." In which bank are the deposits? Are they at Glynn's?

Mr. BECK (deputy-governor): We have no deposits now.

Mr. BOX: I see that there is £5000 at the London and Westminster Bank—are they the bankers of the company?

Mr. BECK: No; but the private banks will not take deposit accounts.

Mr. GIESLER: I have an observation or two to make upon the accounts. I object, not to the alteration in the mode of stating them, because that is what I desired; indeed, I wish there had been a further alteration. But what I now object to, and have objected to, is this continual expenditure, half year by half year, without giving us any statement of what the future is to be. This is a question which I brought forward at the last meeting, and I stated then that the Great Northern, the London and North-Western, and the South-Western Railway Companies, all made a statement of the proposed expenditure for the following half year. In consequence of what I stated, a gentleman present, who is a director of the Brighton Railway Company, got up and gave me a flat contradiction; and, though the meeting agreed with him, and put me down, I have since ascertained that I was correct. I again ask, are we to have any notice of how this money is to be expended? On this occasion we find £13,000 has been expended during the half year, and not a single item to tell us what it is for. Another question on which I remark is this: in the profit and loss account the last item on the credit side to which Mr. Box has alluded is, "Premium on shares re-sold." Why should this be carried to that account? I ask the directors, is this a profit?

Mr. BECK: Yes, we certainly consider it is a profit, and for this simple reason—that the shares, when bought, were paid for out of profits. We think, therefore, that in re-selling them, all the profit beyond the purchase-money, £50, is divisible among the proprietors in the most legitimate way. (Hear, hear.)

Mr. GIESLER: You do not mean to say that those shares were purchased at £50 each?

Mr. BECK: Which do you mean?

Mr. GIESLER: Those that have been re-sold.

Mr. BECK: Some were bought at £55, some at £60, and others at £65.

A PROPRIETOR: And some at £70.

Mr. BECK: Yes; that was many years ago.

Mr. GIESLER: I have known much of the accounts for many years, and I think that, far from being a profit, there has been a loss by the transaction.

Mr. BECK: Not upon this half year. All your cost for the purchase of shares has appeared in the accounts in years gone by.

Mr. GIESLER: I think the £1755 belongs really to the capital account, and has no right to be put in profit and loss.

Mr. BECK: You cannot possibly carry it to the capital account.

Mr. GIESLER: I think I could find an accountant in the City of London who could arrange the matter without any difficulty or mystification; and, notwithstanding your answer to my inquiry, I still object to it. I also repeat the inquiry, which from time to time I have made at these meetings. I want the directors to tell us what it is their intention to spend out of their capital account for what they call "new works," but which are not new works. I want also a statement of what has really been expended upon new works.

Mr. BECK: You have had it told to you at every meeting, and I will tell you again to-day.

Mr. GIESLER: I beg your pardon; I have never had it given to me as it ought to have been, viz., as the Commissioners of Sewers used to give their accounts in the public papers, where they told you every yard of new sewer they were about to construct. I want to know whether what you call "new works" really are new works, or merely the replacing of old—taking up one pipe and putting down another.

Mr. SCOTT: Perhaps I may be allowed, as the honourable proprietor has alluded to me, to make one observation. On the last occasion he stated that it was the custom of *all* the railway companies to give the particulars of new works in contemplation by the directors, and in answer to that I said that the Brighton directors did nothing of the kind. I believe our board will be only too happy to satisfy every proprietor to the utmost of their power, but it is often impossible to indicate the probable expenses in every succeeding half year.

Mr. BECK: I put it to the meeting whether Mr. Giesler has not always had the information which he sought. But when he has got it, he then turns round and says, "Yes; but that is not in the way I like to have it." Now I submit that we are the parties to decide how the accounts shall be put before you; but do not impute anything like "mystification" where none exists. Mr. Giesler says there is "mystification" in carrying the £1755 premium on shares re-sold to profit and loss. Surely there can be none in the matter; the fact is broadly stated, and we tell you that we believe it is proper to insert it in that account. You have been debited in past years with the cost of the shares, which were paid for out of profits, and when those shares are re-sold, the profit realized by the transaction must be carried back to the credit of the same account. (Hear, hear, hear.) You cannot capitalize those premiums. Your capital is a certain amount; you bought up a portion of that capital at different periods, and you can only carry back the same amount. If you refer to the balance-sheet you will see that the amount of the 1st, 2nd, and 3rd capitals, at Midsummer last, was £529,050. Then we have the amount of 1st capital upon shares re-sold this half year, £22,450—that we have raised. The amount of the 4th capital at Midsummer last was £51,640, and we have raised upon new shares £8360 this half year; making altogether the total by re-sale £30810. I think there is the fullest information given to you on this point. Then we show you how this has been expended. If you refer to the previous half year's account, you will find it stated that we had expended at the Westminster station £319,476. We now tell you that this half year we have expended £9808 there. Mr. Giesler says that he has not got all the items: but did you ever see the account in which they were given? But I can tell him what they are. We have expended for tank and gasholder, £7545. 19s. 6d.; for exhausters, £288. 10s. 7d.; for mains, £1788. 0s. 5d.; for still for distilling naphtha, £138, and so on—here they all are: the total of the items being, for Westminster, £9808; for Brick Lane, £1973. 4s. 9d.; and for Curtain Road, £13. 4s. 7d. Then, Mr. Giesler says, "I want to know whether this is for new works, or merely the replacement of old ones." I reply, we have acted in this way: if we have taken up a 6-inch main and laid down a 10-inch, we have estimated the cost of the 6-inch, and deducted that from the cost of the 10-inch, and carried the difference to capital. But we cannot give you all these details in an account of this kind; it would be impossible, and we want to make everything as clear as we can. Well, then, I said that at Midsummer the capital expended at Westminster was £319,476, and that since that period we have expended £9808. If you refer to the last half year you will find an amount placed to the debit of new works, £8252. 12s. 5d. Mr. Giesler or Mr. Box, I forget which, says we are charging the cost of new works to profit and loss——

Mr. BOX: No; it did not come out of profit and loss, it came out of revenue.

Mr. BECK: What is the revenue account but the account of profit and loss?

Mr. BOX: There's a great difference; the revenue account is made up of many different amounts.

Mr. BECK: You will find debited to new works last Midsummer the sum of £8252. 12s. 5d., which being actually due, but having no capital to pay it out of, we carried by degrees to profit and loss, charging £2000 one half year and £2000 another. But when we raised new capital, and were able to pay for new works, we credited the new works account, and debited capital with the amount, which we then divided among the stations, according to certain proportions. I think nothing can be clearer than that. We give you the amounts charged for each station, and show you how we have got rid of the sum of £8252, which, on the previous occasion, appeared at the debit side of capital. I think there is no other item that requires explanation. You will see that our total capital is £611,500; that we have expended £546,734, leaving us a working capital of £64,765. The only other point, I believe, which requires observation is, as to stating what new works we intend to do, prospectively. It is utterly impossible for a gas company to do this. For instance, since Christmas we have resolved, in consequence of the great increase in our consumption, to take steps by which we shall increase our manufacturing power at this station to the extent of from 30 to 33 per cent. But we could not tell you about that in our report, for it was not then resolved upon. We did tell you about the gasholder, because we had made up our minds upon the subject; but this we could not foresee. At the end of this half year we shall take into consideration what is the production of the old retort houses and different things, and see what may be charged to revenue and what to capital.

Mr. RHODES: There is one item in the accounts which always strikes my mind, and that is with respect to the falling off in the products. I think there must be something underhand on the works, not, I am sure, with the sanction of the board, in reference to the supply of coke.

The CHAIRMAN: The supply of coke is much greater than the demand. I have endeavoured to impress it upon the minds of our proprietors at the last two meetings that they might put money into their own pockets, and conduce very much to the comfort of their own firesides, by consuming coke instead of coal.

Mr. RHODES: That is not exactly my point. There is a quantity of coke made at each station, and I want to know how that returns into our accounts as money.

Mr. BECK: Do you mean are we getting paid for the coke sent out?

Mr. RHODES: I will just suppose a case. You make 1000 chaldrons of coke in these works; you send out 900, and of course you expect it to produce 900. But when the account of coke delivered comes into your office, it does not produce 800.

Mr. BECK: Oh yes it does; there is not a sack goes out but what the man takes a ticket, the counterpart of which is kept, and which says how much coke has been delivered to him, and in how many sacks. The man at the gateway takes the ticket, and sees that no more coke goes out than is expressed on it.

Mr. RHODES: That is not the point.

Mr. BECK: I state this to show that nothing goes out, as far as we know, but what we have a return for. Every ticket and item is entered into a day book, and from thence into a ledger which the directors examine from time to time to see if it is correct. We have no reason to suppose that a single sack goes out of which we have not evidence.

Mr. RHODES: But suppose I bring twelve sacks to be filled with coke, are those sacks measured in any way to know whether they hold too much or not?

Mr. BECK: Our man knows pretty exactly what a sack will hold by the appearance of it. If it appears to be larger than usual he has it measured; but it would take no end of time to measure every sack that comes in.

Mr. GRAY: I would suggest to the honourable proprietor whether he would not get all the information he wants, and satisfy himself as to the difference in the quantity of the coke, by asking how much is used in carbonizing.

Mr. RHODES: Have not some sacks gone out filled which are much larger than others? Is there not such a thing as "tobacco money?"

Mr. BECK: I have no doubt there has been, and whenever we have found it out we have always discharged the man who has been guilty. We take every means in our power to prevent roguery, but still instances will, no doubt, occur. We have adopted the resolution to prosecute every man detected in defrauding us.

Mr. RHODES: Respecting the price you get—would it not be well if more uniformity existed among the several companies? We should then produce a larger amount.

Mr. BECK: We keep ourselves informed as well as we can as to what other companies are selling at; but we get 8s. or 7s., as the case may be, for we know that if we keep the coke two or three days it is depreciated very much.

Mr. RHODES: The other companies are willing to unite to preserve a uniform price.

A PROPRIETOR: You can't fix the price of corn at 50s. As to the measurement of your coke, I may state that the Phœnix Company, at their Greenwich Works, measure theirs by a sack of their own, and they do not fill any customer's sacks from the heap as they used to do. It used to be the fashion for men to take two large sacks to the works to be filled, and when they got outside, to make them into three.

Mr. BECK: We have such a measure as you speak of; but how are we to prevent roguery, even if it were constantly used, unless we stood over the men?

A PROPRIETOR: But, if you allow them to go to the heap and fill customers' sacks, you can have no rule at all.

Mr. BARKER (a director): We have attempted to measure the coke sent out by this machinery; but we have competing companies to deal with, and we have always found that we sold less coke next day. When the customer has got his ticket for the quantity he wants, he goes into the yard to the

foreman, who, if he sees that the sacks produced are extra large, has them measured. We have repeatedly done that, but have not found the extra quantity that we imagined there was. If we were to trouble all our customers to ascertain whether one sack held a peck more than another, do you think they would trouble to come to us at all?

A PROPRIETOR: I shall move "That the directors take such steps as may be needful to ascertain that every chaldron of coke goes out of the works as a chaldron."

Mr. BECK: I have said that we have an iron sack for the purpose, which holds three bushels; but, if we were to measure every sack that goes out, it would never answer. We have a foreman in this department, and, if he has any suspicion upon the subject, he measures the customers' sacks.

Mr. BARKWITH: If you were to measure every sack of coke that goes out, it would increase the cost to such an enormous extent, that you would be very dissatisfied. Our foreman knows as correctly as though they were measured whether a sack holds three bushels or three bushels and a peck.

Mr. JOHN BOX: It is a question talked about out of doors, that the sacks are filled without being measured, just as they used to do in the old-fashioned times in buying a load of coals. Then they took them from the barges without any check at all as to quantity.

The CHAIRMAN: You have talked a great deal about the measurement, but only make a demand for coke, and the measure will be of very little importance.

Mr. JOHN BOX: I say it is quite unbusiness-like to have men come into the yard, and have a sack and a half of coke for one.

Mr. W. HAWES: The real question before us is this, have we confidence in the directors that they are employing such men as their servants that we may have tolerably good security against fraudulent dealing? It is quite true, and every one who has had anything to do with conducting a large factory knows it well, that, notwithstanding every precaution, you are still liable to fraud; and it is equally certain that, in reference to a bulky commodity of little value like coke, you may easily adopt measures by which you can save a penny at the expense of a pound. (Hear, hear.) To measure every sack of coke sent out from these works would cost more than you imagine, and would reduce the real value of the article much below what it is. But why do the honourable proprietors who object only refer to the coke? why not put the same question as to the gas supplied by us? Why not ask whether the persons who go round to ascertain the state of the customers' meters are not bribed with "tobacco money?" You may raise the same question on every item of revenue; and though there can be no harm in such a discussion, but it may tend to make the directors more alive to the subject, yet, after all, the real question is, have we confidence in our board. There cannot be two opinions on this point, that though there may have been exceptions, the directors have, upon the whole, employed proper persons in the works. (Hear, hear.) There is another point upon which I should like to say a word. At every one of our meetings our time is occupied with complaints that a priority of information in reference to the company's affairs is not given to some particular shareholder. Now, I put it to the meeting, and I think we are bound to decide, whether the directors should be called on to place the facts of the prosperity or adversity of the company in the hands of any one individual—whether you are going to issue new shares, or whether you are going to pay 6 or 7 per cent., to make use of that information for his own benefit and to the detriment of the company? (Hear, hear.) I think it is a matter which ought to receive the attention of the directors, whether or no information as to the state of our affairs is to be given to the proprietors collectively or individually, for the general benefit or for personal advantage. (Hear, hear.) There is one other point too, and that is with regard to the £1755. The meeting will know, I presume, that this is restored capital by shares originally cancelled. Those shares were bought in the market beyond the regular share price, and the difference between that price and the sum paid for them was charged to profit and loss. You paid it out of profits, and can there, therefore, be any doubt when you replace that capital, and re-sell those shares in the market, if you get something more than the original price, that the sum so obtained should go to the credit of profit and loss? (Hear, hear.) It is, in fact, but the repayment to the company of a loss formerly incurred; and I think there can be no two opinions that the directors have treated this matter for the benefit of the shareholders. (Hear, hear.)

Mr. JOHN BOX: It would have been much better if the directors had offered those shares to the proprietors at par, and not called upon them to pay a premium upon them.

The CHAIRMAN: We did offer them.

Mr. BECK: We sent a circular to every proprietor, asking them what number they would take.

Mr. SCOTT: I think the question of the amount obtained by us for coke is a very important one. We get but little for it, and yet I know that the railway companies are paying a very high price for the article. I think if we were to advertise fairly and fully, so that the subject was brought before the public more, we should get more customers out of doors.

Mr. BECK: We have many private customers.

A PROPRIETOR (to Mr. Scott): Would it do for use on the railways?

Mr. SCOTT: Yes, I think it would, if partly mixed with other kinds.

The CHAIRMAN: We have a good many customers among brewers, &c.

Mr. BECK: The real cause of its not being so remunerative is that the supply exceeds the demand. There is a difference in our returns last year and those of 1854 of £14,000.

Mr. RHODES: I want to ask one question respecting the finances of the company. Many public companies are at a low ebb just now, owing to frauds having taken place in the transfer of shares. Have you looked well into the matter of the transfer of our shares since these unpleasant revelations out of doors?

The CHAIRMAN: Yes, we have carefully.

Mr. JOSEPH BOX: In the accounts for the last two or three years you have mixed up the returns for coke, breeze, tar, and ammonia. From the commencement of the company up to the time that these accounts were printed, we used to have the amounts for each of these products given separately. Would there be any objection to do the same again?

The CHAIRMAN: We think it better to have short accounts than long ones.

Mr. BECK: They are not all mixed together. There is "Coke and breeze," £16,183; and "Tar and other products," £2170.

Mr. BOX: These are all given separately in every other company.

Mr. BECK: Is it done in the Phœnix?

Mr. BOX: Yes, I know it is, because I am an auditor of that company. I shall move that for the future they be printed separately in this company. There has been a great deal said at different times about private information obtained about the affairs of the company, and made use of for personal advantage. Now, I have received a great deal of information at various periods from the office, and I do not believe there is any gentleman in the direction of this company who will say that I have ever made use of it discreditably, or to the damage of the interests of the concern. I do not believe there is one gentleman here who will insinuate such a thing; but on the contrary, the information I have obtained has enabled me to bring matters before our meetings which the proprietors otherwise would have been ignorant of. With respect to the coke, I am a director of another gas company, and I will tell you how we have been used. (The honourable proprietor proceeded amidst many signs of impatience to relate a series of frauds practised at some provincial gas-works, with which he had been or is connected.)

Mr. BECK (interrupting): And were you a director at the time? (Laughter.)

A PROPRIETOR: Mr. Box is talking about a regular system of fraud, but that has nothing to do with the question now before us. (Hear, hear.)

Mr. BECK: I really thought we had guarded ourselves against anything of the sort; but now I find that even Mr. Box himself has been deceived, I don't know what to say. (Laughter.)

Mr. BOX: I shall move that the items I have referred to be given separately in future accounts. I hope some one will second it.

The CHAIRMAN: I hope no one will second it.

Mr. JOHN BOX: I certainly shall—(a laugh)—but I put it respectfully to the directors whether they will not yield to the request without a distinct resolution of the meeting.

The CHAIRMAN: You may have the coke separately if you like; but the question is, whether or not the proprietors are satisfied with the accounts as now rendered. (Hear, hear.)

The Messrs. Box persisted in pressing their motion.

Mr. BECK: I have all the items before me, but there is a reason why we do not give you the exact results on the separate items of naphtha and tar. During the last two years we have been trying some experiments with a certain kind of coal, which has been very productive in some of these residuals; but, if we give you the items, it may raise the question with other companies, and tend to increase the price of the article. (Hear, hear.) That is the only reason why we do not give them to you. There is a particular product which we get perhaps £1000 a year more from than any other company working the same coal, and therefore it is really a matter of discretion, and the shareholders must have confidence in the directors. (Hear, hear.)

A PROPRIETOR: Mr. Box is a director of another company, and perhaps he wants it for them.

Mr. BECK: Various kinds of inland coal are coming much into use, in opposition to Newcastle, and we are trying every one of them. Mr. Evans, who is a very clever chemist, has been making experiments, which have been successful, but we do not want the results to go forth to the public, which would only tend to raise the price of the coal upon which he has experimented. Moreover, it cannot make the slightest difference to the proprietors whether we get £1000 in one item or in five. (Hear, hear.)

Mr. GIESLER objected to Mr. Beck's observations. Whenever any question was asked which the board did not like to answer, it was always said that the proprietors must have confidence in the directors.

Mr. BECK: I did not mean a general confidence, but a confidence in this particular, and that they have prudential motives for not giving you the separate items.

Mr. HOPWOOD: There are many subjects upon which I think information should not be given to the public.

Mr. GRAY: The question resolves itself into this: Can the directors furnish the information which Mr. Box asks for without doing some disservice to the company? If they are of opinion that it would, then in the discharge of their duty they are perfectly justified in withholding it. (Hear, hear.)

The CHAIRMAN: It would put money into the coalowners' pockets. I should be very glad if Mr. Hopwood would put us into a better way.

Mr. HOPWOOD: I did not say anything against it.

The CHAIRMAN: Do you think the accounts are properly stated?

Mr. HOPWOOD: Undoubtedly.

The CHAIRMAN: We go the surest way to attain our ends. All that we have done we hope will be productive, but it is not always so at the first. You will see a large sum this half year for meters and services. At first these things are a positive loss to us, and it requires time for them to work out a profit.

Mr. GRAY: Much has been said about your giving too large a measure of coke. I am perfectly satisfied that if you make the regulations at gas-works too stringent in this respect, your customers will not come to you. We have tried the experiment, and found this to be the consequence; and what will compensate for the loss of good customers? If they once leave you, you will get bad ones at a low price. With respect to what has been said about getting gas companies to come to an understanding, I believe it is morally impossible; and, if possible, it would be very unwise. (Hear, hear.) We frequently correspond with other companies to endeavour in some way to regulate the price of coke, but there are certain circumstances peculiar to each which must always operate to affect the price. You get a heavy stock on hand, and then you are obliged to come lower in order to clear it away.

Mr. PERRY: I think, if we have any confidence at all in the directors, this matter should be left to them. I feel that the worthy chairman and his colleagues have acted very judiciously and wisely in withholding those peculiar supplies of information which are calculated to injure the company to a considerable degree. I think, too, that for the labours they have had to sustain, the directors demand our hearty thanks. I am perfectly satisfied with the accounts as they are; for, though I should like them to be more detailed, yet, when I find such a reason assigned for their not being so as that which the worthy deputy-chairman has stated, I think that is amply sufficient. (Hear, hear.)

The CHAIRMAN: Any gentleman may come to the works and see them.

Mr. PERRY: It has been said that peculiar privileges have been given to one individual in reference to the accounts. Now, I believe that no other proprietor has asked for that specific information but this gentleman; and all I can say is, that I have never asked for any account but I have had it. I have been here with gentlemen in former years, and have gone through every account in the books, and the accountant has explained to us every branch and detail. I feel assured that I should be equally satisfied if I wished to go through them again.

The CHAIRMAN: Will Mr. Box be good enough to withdraw his amendment?

Mr. BOX: Will there be any objection to give the coke and breeze returns separately?

The CHAIRMAN: No; we will give directions to have that done immediately.

Mr. BOX: Then I waive every objection except this: your expenditure this half year in producing the revenue here shown is more than 2 per cent. more than it was last half year. The per centage is now 84·42, whereas in June, 1855, it was only 82. Your present revenue is £109,259, and your expenditure £92,234.

Mr. BECK: There is one fact which you must keep in mind, for it has a great bearing upon this point. At Christmas, 1855, we showed that our coals had cost for the previous half year £43,457; at midsummer they were shown to have cost £50,895; and the accounts now presented up to Christmas show that the consumption has been £49,372. This makes all the difference.

A PROPRIETOR: I think as the variation is only 2 per cent. it is too little to waste much time in discussing.

The CHAIRMAN: Our salaries were 3½d.; they are now 2d. and less than a farthing.

Mr. BOX: But your salaries are mixed up with labour charges now.

The CHAIRMAN: No, they are not.

The motion for the adoption of the report was then put and carried.

The CHAIRMAN brought up the minute of the court of directors of the 17th of April last, submitting, for the approval of the proprietors, a dividend at the rate of 6 per cent. per annum upon the amount of capital as it now stands, and free from income tax.

The SECRETARY having read the minute—

Mr. PERRY moved, and Mr. RHODES seconded the following motion, which was unanimously adopted: "That the dividend declared by the court of directors be approved and adopted, and payable by warrants upon the treasurer on and after the 11th day of May instant."

Mr. GRAY moved, and Mr. RHODES seconded a vote of thanks to the governor and court of directors for their zealous exertions in promoting the interest of the proprietors during the past six months.

The motion was cordially agreed to, and, having been briefly acknowledged by the chairman, the proceedings terminated.

ORIENTAL GAS COMPANY (LIMITED).

The Fourth Ordinary General Meeting of the Shareholders of this Company was held at the London Tavern, on Wednesday, the 6th inst., in conformity with the company's deed of settlement—Captain BARBER in the chair.

The notice convening the meeting having been read, and the corporate seal affixed to the register of proprietors,

The SECRETARY (Mr. H. J. Baddeley) read the following annual report of the directors:—

Gentlemen,—In accordance with the provisions of the company's deed of settlement, the directors have now to submit to you their report upon the existing state of the company's affairs. The accounts have been carefully audited up to the 31st of December last, and the balance-sheet, which will be laid before you, includes all the assets and liabilities of the company, both in London and Calcutta, up to that date.

Since the last annual meeting in May, 1856, the constitution of joint stock companies has been somewhat varied by an Act of Parliament, under which your directors, with the express sanction of an extraordinary general meeting of shareholders, duly caused this company to be registered with limited liability. Up to that period the responsibilities of this company had been wholly borne by your directors, without asking you to share with them any liabilities which might be incurred during the progress of your undertaking. The law of limited liability having come, however, into operation, scripholders were required to deposit their scrip, as a preliminary step towards registration, at the offices of the company, on or before the 5th day of December last. Among the script certificates of shares sent in, documents purporting to represent shares in this company were suspected by the secretary to be forged. Your directors having confirmed his suspicions, thereupon promptly adopted means to caution the public against dealing in the company's shares until they had been duly registered in accordance with the notices which had been issued; and, in congratulating you that no loss has been sustained by the company through the delinquencies of the evil-disposed persons who simulated the company's scrip, they are induced to believe that the efficiency with which the registration of this company's shares was conducted, alone prevented a much more extended circulation of the forged documents than those which were actually presented for registration at the offices of the company.

Your directors are able to announce to you that powers similar to those ceded to gas companies in England have been conferred upon this company by an Act of the Legislative Council in India, which will enable them to prosecute the objects of this undertaking with greater advantage to your interests.

The directors feel regret that they are not, as they anticipated at the last annual meeting they would have been, in a position to report to you the actual lighting of Calcutta with gas. The causes to which the non-fulfilment of their anticipations may be ascribed are two-fold, namely, the sudden illness of the company's engineer, and an accident to the gasholder-tanks. At the date of the advices embodied in the last report, Mr. Wilton was actively employed in carrying on the works as engineer-in-chief, consequent upon Mr. Cowan's return to England, and with every prospect of making due provisions against the coming rainy season. His energies at Calcutta however, in your service, subjected him to the influences of the Indian climate, and on the 16th of May last, Dr. O'Shaughnessy advised his immediate departure for England. That intelligence was received simultaneously with Mr. Wilton's arrival here, so that your directors were precluded from providing against the second contingency, namely, the accident to the gasholder-tanks, caused by the premature setting-in of the heavy rains, with unusual violence, before the works to protect them from such pressure had been finished. Your directors are now confidently assured that the tanks have been completed in the most substantial manner, under the superintendence of Mr. Billows, the company's present engineer-in-chief, who, in conjunction with Mr. How as his assistant, arrived in Calcutta in the month of September last. The delay which has therefore arisen is beyond the control of your directors, who only desire that you may be correctly informed upon the true nature thereof, and lament to add that intelligence of the death of the assistant engineer, Mr. How, has lately been received at the offices of the company, when the directors lost no time in filling up the vacancy thus occasioned, and have secured the services of Mr. Durkin as his successor, who is on his way to India. In the meantime his place has been supplied by a resident engineer, so that the company will not suffer any inconvenience therefrom.

Your directors have much pleasure in calling your attention to an extract from the managing director's letter of the 7th of February last, namely:—

"Mr. Billows' letter will inform you of the progress of the works; but I may briefly mention that the whole of the retorts on one side of the retort house are set, the ascension-pipes, mouth-pieces, hydraulic main, flue, and shaft, all completed, *and ready* for the *manufacture of gas to-day*, if required; scrubbers, purifiers, condensers, and steam-engine, all set up and within a few days of being perfected. Mains laid from Narkuldangah to Soorty Bagan Station, and from there down Coolootollah, up the Chitpore Road as far as Neemtollah Street, and down from Coolootollah along Lower Chitpore Road, Cossitollah, Chowringhee Road *completed* as far as Sudder Street, and we are laying down rapidly at both extremities. We shall complete Chowringhee Road, at the rate we are going, in about a fortnight. Mains are also laid from Espianade Row, along Government Place, and Old Court-House Street, passing Wilson's Hotel, F. W. Browne's and some first-class shops, and down the south side of Tank Square, past our own office to the Police Ghat. Everything is in a most forward state. I am putting down a 2½-inch main into Prosono Coomar Tagore's street, to carry gas to his house, and the family of Ashotoss Day occupying five large houses seeing this, sent to me yesterday to have it taken at once to their premises. The Mullicks also have applied. No doubt the wealthy natives will go into it at once, and on a large scale."

And also to another extract from his letter of the 21st of the same month, namely:—

"The prospect of a speedy introduction of gas lighting into the wealthy native houses you will be glad to hear is good. Our friend Prosono Coomar Tagore has already laid out between 3000 to 4000 rupees at Messrs. Messenger's, for lustres, &c., and his example will, we hope, be speedily followed."

These extracts are extremely satisfactory, because they show an increasing disposition on the part of the natives to avail themselves of the boon which this company has undertaken to place within their reach. Your executive never doubted the readiness of the European population to encourage private lighting by gas; but they do congratulate you that the native prejudice is fast disappearing before the development of your enterprise.

As your directors receive by every mail renewed assurances of success, they consider that the time has now arrived when they can advise a division of the interest which has accrued since the formation of the company. They therefore recommend the payment of 1s. 6d. per paid-up share (free of income-tax) on and after the 21st day of May inst., to such shareholders who have already executed, or shall thereafter execute, the company's deed of settlement.

The retiring directors upon this occasion are John Allan, and James Barber, Esqrs., and the retiring auditors are James Sydney Stopford, and Henry M'Lauchlan Backler, Esqrs., who, being eligible for re-election, offer themselves accordingly.

Your executive have much gratification in stating that they have sought the assistance in the management of your affairs of two gentlemen whose united advice and experience, founded upon a knowledge of gas affairs and joint stock companies, have much strengthened the constitution of your direction. Although John Gill, Esq., and Walter Thomas Fawcett, Esq., have for some time past occupied seats at the board, they formally present themselves to you at this meeting for election, that they may act in conformity with the company's deed of settlement.

You are also required, in accordance with the deed, to determine what amounts shall be annually allowed to the directors, out of the funds of the company, as a recompense for their trouble in the management of the affairs thereof, and what annual sum shall be paid to the auditors for their services in the audit of your accounts.

Your directors cannot conclude this report without bearing testimony to the great zeal and ability shown by William Anderson, Esq., your managing director, and his colleagues in Calcutta, in the conduct of this company's affairs, and congratulate you that the present position and future prospects of the company are so promising in every respect.

BALANCE-SHEET TO DECEMBER, 1856.

Dr.				*Cr.*			
To 50,000 shares of £1 each			£50,000 0 0	By outlay as per balance-sheet to December, 1855.		£31,718 10 1	
50,000 shares upon which a deposit of 2s. per share has been paid			5,000 0 0	Do. to December 31, 1856, viz.:—			
Interest to December 31, 1855	£3,098 10 9			Passages of engineers to India, and travelling expenses	£ 431 16 0		
Do. do. 1856	611 4 9			Machinery and material, and tools	2,033 8 4		
		3,709 15 6		Pipes and main-laying	5,064 16 8		
Contingent-fund		1,711 9 0		Freight and insurance	2,095 10 11		
				Buildings	9,194 8 10		
				Salaries and wages in India and London	2,146 4 5		
				Directors' and auditors' fees	514 10 0		
				General expenses	1,970 12 9		
				Postages, office furniture, advertising, printing, and stationery	244 11 7		
				Exchange and commission	40 16 4		
						23,786 15 10	
							£55,505 5 11
				Balance in Calcutta, viz.:—			
				Cash	£ 652 12 2		
				Stocks	1,182 8 3		
						£1,835 0 5	
				Deposit account	£2,500 0 0		
				Current do.	580 18 2		
						3,080 18 2	
							4,915 18 7
		£60,421 4 6					£60,421 4 6

The CHAIRMAN: Gentlemen, you have heard the report and balance-sheet read. They contain a true and faithful statement as to the position and prospects of this company, and I do not think I can add anything to their satisfactory character by offering any lengthened observations. I shall, therefore, content myself with performing the simple duty of moving, "That the report and accounts be received and adopted."

Mr. BROWN seconded the motion.

A PROPRIETOR inquired whether 5s. had not been paid upon all the new shares. In the accounts just read it appeared as though only 2s. had been received.

The CHAIRMAN: These accounts are made up to the 31st of December last. At that time 2s. only had been paid; the remaining 3s. have been paid since.

Mr. CHOWNE: In the report reference is made to forgeries having been discovered in some of the scrip certificates of shares sent in for registration. I suppose that was only to a trifling amount.

The CHAIRMAN: I apprehend that it would have been found to be a very large question, if we had not fortunately been able to checkmate at the first move. The whole number of forged shares sent in was 1250, but from the system adopted at the office, the secretary detected the first that was presented for acceptance and registration. The morning following that discovery, while I was in the committee, a gentleman produced a thousand of that character, and I took a pen at once, and wrote across them in red ink, "Forged."

Mr. CHOWNE: Then the company have actually sustained no injury from these frauds?

The CHAIRMAN: Not a farthing.

Another PROPRIETOR: The statement just made is very satisfactory. I shall be glad if the chairman will inform us whether the life of the engineer who went out and died was not insured for a large amount?

The CHAIRMAN: Yes, it was. You will see by the debit side of the account the item of "Contingent-fund, £1711. 9s." That contingent-fund arose in this way: When Mr. Danré, our late engineer-in-chief, went out to India, a large expense was incurred, and we came under certain advances, to cover which, at my suggestion, his life was insured for £2000. When, on his death, that money was received, the subject was looked at in all its bearings by the board, before deciding how it should be applied. It decidedly could not be placed to capital, for it certainly was a profit realized, and we determined at length to keep it so as to form a contingent-fund. The charges upon it up to the present time have been for the premiums on his life policy, and on the policies now running on our other engineers' lives. We have also paid a gratuity to the widow of Mr. Cowan, who, since his re-

turn from India, has also died. In Calcutta also our workmen have set a noble example in contributing a sum of money to a widow of one of themselves, and we doubled the amount which they raised. (Hear, hear.)

The PROPRIETOR: Although, of course, it is an unfortunate thing that we have had to realize profit in such a way, yet I must give the board credit for their sagacity in providing against such sad contingencies. (Hear, hear.)

The CHAIRMAN: I may just state that we have been unfortunate in losing another engineer, whose life was insured for £1000. That amount has not yet been received.

A PROPRIETOR: I should like to ask what probability there is of Calcutta being speedily lighted with gas, and whether the directors have received any advices from their engineer since Mr. Billows' letter of the 21st of February last?

The CHAIRMAN: The directors have received a letter, in which the engineer says they are pushing on the works with as much energy as possible, and will soon be able to inform us when the lighting will commence.

Dr. BEATTIE: I suppose it would not pay to commence making gas, and supplying those places where the mains are already laid?

The CHAIRMAN: Yes, it would; and we are making arrangements to enable us to light up, say 200 lights, until the others are got ready.

The motion was then put, and carried unanimously.

Dr. BEATTIE: I think it would be desirable that the reports on all future occasions should be sent to the proprietors a few days before the annual meeting.

The CHAIRMAN: There can be no objection to such a course, if it is the wish of the meeting.

Mr. HAMMACK moved, and Mr. J. P. JUDD seconded the re-election of Messrs. Allan and Barber, the retiring directors, which was cordially agreed to.

The CHAIRMAN: Gentlemen, I am very much obliged to you for this renewed expression of your confidence in my exertions. When I joined this undertaking, I certainly did so with a great desire to be instrumental in supplying what I believed was a great want in Calcutta; and I hope we shall be able, notwithstanding the delays which have taken place, to bring this concern to a highly remunerative result. While accepting your re-appointment, I can only say that, if at any time you feel that my place can be better filled for the prosperity of the company, I shall be willing at once to retire; but that while I hold it, I will give my best attention to promote the efficiency of the undertaking. (Hear, hear.)

Mr. ALLAN: I also return you thanks, gentlemen, for re-electing me. My long residence in Calcutta makes me feel a deep interest in the success of this company, and I hope that the local knowledge which I possess of that city and its vicinity has added something to my usefulness as one of your directors.

Dr. BEATTIE: What position are the public authorities in at Calcutta in reference to the adoption of gas? Have they got posts and lamps? Supposing we were prepared now, are the authorities ready?

The CHAIRMAN: I think, in answer to your question, that I shall satisfy you that the directors have had the same foresight, for which you have given them credit in other arrangements. When we first embarked in this undertaking, you remember, the East India Company had a charter; but soon afterwards that charter was abrogated, and an Indian bill was passed. Although the conservancy commissioners had full authority from the governor-general in council to proceed with great vigour, and did call upon us to use every exertion to light Calcutta with gas, they were a little timid, and did not choose after that bill was passed to incur responsibilities, or take upon their own shoulders the outlay of monies which they did not see their way clear to have defrayed. We urged upon them, mail after mail, to order the necessary posts and lamps; for we felt sure that otherwise we should have our mains laid, and our preparations complete, before they were ready. They were also urged, strongly urged by our Calcutta committee to do so, but they would give no orders; whereupon we came to the resolution to send out 200 posts and lamps, taking the responsibility upon ourselves should it turn out that the patterns and styles would not suit; and, of course, at the risk of having them thrown upon our hands. However, they have since thought otherwise, have confessed themselves much obliged to us, and have taken the lamps and posts upon their own account. They have also written home direct to the manufacturers, Messrs. Messenger, to send out 300 or 400 more. In fact, I am not quite satisfied whether we should not have ground to claim compensation from the Government if our mains were laid before they were prepared, because they were to find the posts and lamps, and we have only to keep them in repair.

Mr. CUNDY moved, and General SANDYS seconded the re-election of Messrs. J. S. Stopford and H. M'Lauchlan Backler, the retiring auditors, which was agreed to.

Mr. STOPFORD, in returning thanks, said: It will be satisfactory to the proprietors to hear that the audit has been a real and a scrutinizing one, and not a sham one, such as we have heard of lately. Every voucher and document has been examined, and your accounts have been kept in a most satisfactory manner. (Hear, hear.)

The CHAIRMAN, in moving the election of Messrs. Gill and Fawcett to seats at the board, said: We felt it important to strengthen our position in managing the affairs of this company on legal points and on practical matters connected with gas making; and, not wishing to be always referring to our solicitor and consulting engineer, we took into our councils the gentlemen whose names have been proposed to you, and I can only say that they have most ably supported us. Mr. Gill, as the manager of the Ratcliff Gas-Works, is thoroughly conversant with the details of gas making, and all the apparatus required; and, in his knowledge of the joint stock company law, Mr. Fawcett has been of the greatest service to us, especially on the occasion of the forgeries to which I have alluded. (Hear, hear, hear.) We have found in Mr. Gill a very valuable auxiliary, and nothing that we have sent out of the country has gone without his previous personal inspection; for we felt that, as we were under heavy responsibilities, it was right that we should see we had money's worth for everything we purchased. In the ordinary course of events, we ought to have asked the shareholders to have selected these two gentlemen; but the fact was, we were in this position, that we could not do so until this very meeting, for no shareholders had signed the deed save the directors themselves.

The motion, having been seconded, was unanimously adopted.

Mr. FAWCETT returned thanks for himself and Mr. Gill.

Mr. LAMBERT: We are required by our Act of Parliament to determine what amount shall be annually allowed to the directors and auditors out of the funds of the company by way of remuneration; and it is only right that the gentlemen who devote their time to the management of our affairs should receive a suitable recompense. In this concern there are two sets of accounts to keep, and a considerable amount of correspondence to keep up between England and Calcutta. There has also hitherto been a large demand upon their attention in the purchase of materials, and the dispatching of suitable persons to conduct the affairs of the company, and the ordinary difficulties of their office have been increased by the deaths which have taken place among the officers. As a matter of justice, as well as of good feeling, we are bound to see that they are properly remunerated; I therefore move, "That from the 1st of January, 1857, the sum of £850 be paid to the directors, and £42 to the auditors, out of the funds of the company."

Dr. BEATTIE seconded the motion, and spoke in highly complimentary terms of the services of the directors.

The motion was carried unanimously, and the CHAIRMAN, for himself and colleagues, returned thanks.

Dr. BEATTIE inquired whether the coal obtained in India had been found serviceable for the making of gas?

The CHAIRMAN said: I am happy to tell you that our engineer has written to tell us not to send out any more coal from England without orders, for that he has no doubt he shall be able to use the coal of the country so as to produce not only gas, but coke as well. (Hear, hear.)

Dr. BEATTIE: Can you dispose of coke there?

The CHAIRMAN: Yes. You know there is a market for charcoal there, and if we can sell coke cheaper, we shall be sure to get rid of it.

Mr. FAWCETT moved, and Mr. CHOWNE seconded a motion for dividing the interest which has accrued since the formation of the company, at the rate of 1s. 6d. per paid-up share, free of income-tax, on and after the 21st of May inst., to such shareholders who have already executed, or shall after that date execute, the company's deed of settlement.

In answer to a proprietor,

The CHAIRMAN said he hoped in another year they would be able to divide among the shareholders a sum of money as the profit of the actual working of the company.

The motion was put and carried.

Mr. THOMPSON moved, and the CHAIRMAN seconded a vote of thanks to Mr. Anderson, the managing director, and his colleagues in Calcutta, for the manner in which they have conducted the affairs of the company there.

The motion was very cordially adopted, and a vote of thanks having been passed to the chair, the proceedings terminated.

INQUIRIES INTO THE QUANTITY OF AIR INSPIRED UNDER VARIOUS CIRCUMSTANCES.

(From the Saturday Review.)

At the last meeting of this society, a very interesting paper was read by Dr. Edward Smith, assistant physician to the Hospital for Consumption, entitled, "Inquiries into the Quantity of Air inspired at each Five Minutes, One Quarter, and Half-Hour of the Day and Night, and under the Influence of various Kinds of Exercise, Food, and Medicine, Temperature, &c." The communication consists of three parts, and comprises the results of 1200 series of observations. The first part contains the results of three investigations as to the quantity of air breathed during the whole of the twenty-four hours, and registered every fifteen and thirty minutes. The second part describes the influence of posture, riding on horseback, travelling by omnibus and railway, rowing, swimming, walking, carrying of weights, the labour of the treadwheel, ascending and descending steps; also of sunlight and darkness, artificial heat, various diets, &c. The third part is devoted to certain inquiries in relation to the temperature of the body. There are not any records of inquiries similar to those contained in the first part of this paper, and extremely few in reference to any portion of the second. The aim of previous observers had been to determine the chemical effects of respiration.

The author was himself the subject of all the investigations. He is thirty-eight years of age, six feet in height, healthy and strong, and with a vital capacity of the lungs of 280 cubic inches. The instrument employed was Glover's patent dry gas-meter of improved manufacture, and arranged to register from one to 1,000,000 cubic inches. The action was reversed, so as to measure inspiration. The mouthpiece employed was Sibson's, and it was connected with the spirometer by vulcanized caoutchouc tubing, and could be fastened upon the head by elastic straps. The determination of the quantity of air inspired in the twenty-four hours was effected by three inquiries:—1st, by using the spirometer whilst in the quiet sitting posture, during five minutes at the commencement of each quarter of an hour, from 5 A.M. to 6½ P.M., and of each half-hour from 6½ P.M. to 3½ A.M. Exercise was taken in the intervals, and food was eaten at 8½ A.M., 1, 5½, and 8½ P.M. 2ndly, by using the spirometer without intermission during the whole of twenty-four hours, excepting at intervals amounting collectively to forty minutes. 3rdly, by an inquiry similar to the second, but continued through the night only. In all these inquiries, the rate of respiration and pulsation, with the temperature of the wet and dry bulbs, and the barometric pressure, were recorded.

Among the most important and interesting results are the following:—The inquiry made during five minutes at the beginning of every quarter of an hour, from 5 A.M. to 6½ P.M., and at the beginning of every half-hour from 6½ P.M. to 3½ A.M., gave the following average quantities in the sitting posture:—After supper, 354 cubic inches per minute; before breakfast, 358; after breakfast, 445; after dinner, 448; and after tea, 454. Mental excitement on several occasions did not influence the quantity of air inspired, when the registration took place only once in five minutes. Sleep occurred with the lowest quantity of air inspired—viz., with 334 cubic inches per minute, but the quantity increased during sleep to 371 per minute. Posture increased the quantity of air inspired—in the sitting over the lying posture, and in the standing over the sitting posture. The increase in the standing over the lying posture varied from 20 to 96 cubic inches per minute. Riding in or upon an omnibus increased the quantity about 250 cubic inches per minute over that inspired when sitting at rest. Riding on horseback increased it, at the walking pace, 450 cubic inches; cantering 900; and trotting, 1300 cubic inches per minute. Railway travelling on the engine increased it 200 cubic inches; in the third-class carriages nearly 200; in the second-class, 150; and in the first-class, 100. The quantity was the greatest at the speed of from 30 to 40 miles per hour. Gentle walking increased the respiration from 169 to 692 cubic inches per minute; when moderate it increased it about 500, and when fast the increase was from 1206 to 1611. Gentle running increased it 1900, and fast running 2325 to 2500 cubic inches per minute. Carrying weights from 20 lbs. to 118 lbs. at the speed of three miles per hour, increased the quantity of air inspired about 1900 cubic inches per minute. Heat and sunlight increased the rate of respiration from 16·8 to 17·8 per minute. Darkness lessened the quantity of air inspired to the extent of 32 cubic inches per minute. Considerable increase of artificial heat caused increased respiration, and considerable decrease the contrary, and these changes increased by continuance.

The author next gives the effects of a great variety of food and drink on respiration. The most remarkable changes were produced by the following articles Milk increased the respiration 33 to 49 per minute; potatoes, only 0 to 6; coffee, 19 to 25: tea, 28 to 96; sugar, 60 to 88; rum, 34 to 42; whilst, on the other hand, cod-liver oil decreased the quantity of air inspired 10 to 65 cubic inches per minute, and olive oil 94 per minute. The

temperature of the breath varied with that of the inspired air, but not proportionately. It was, on the average, 94°·7 in the room, and 89°·1 in the open air.

In the last part of the paper, Dr. Smith proceeded to notice the most remarkable deductions which may be drawn from his investigations. The detailed and averaged quantities of air breathed by him at various periods of the day, and under certain defined conditions, permit an approximative estimate to be made of the quantities breathed by various classes of the community, and of the quantities of chemical elements required to combine with the oxygen. Thus an unoccupied gentleman probably spends nine hours in the lying posture, eleven in the sitting posture, one in walking, at the rate of two miles per hour, and three hours in standing, or walking at the rate of one mile per hour. The quantity of air thus inspired by him daily may be estimated as follows:—

9	hours in the lying posture		243,000	cubic inches.
11	„	sitting	351,780	„
1	„	walking	66,000	„
3	„	standing	144,000	„

giving a total of 804,780 cubic inches of air breathed daily. An ordinary tradesman may be estimated to pass eight hours and a half in the lying posture, six in the sitting posture, three in walking, and four in standing. He will then breathe a total daily quantity of 958,580 cubic inches. The hard-working labourer will probably breathe 1,368,390 cubic inches of air daily. The three classes thus differ greatly in the quantity of oxygen which they inspire, and therefore in the quantity of food required by them; and if each obtained a suitable quantity of material to unite with the oxygen, the labourer would still have greater wear of system than the unoccupied man.

The estimation of the wear of system from various kinds of labour may be made from this inquiry, if the quantity of air inspired may be regarded as a tolerably fair indication of that result—such, for example, as the hard labour of felons, the marching of soldiers, and the ordinary mode of travelling by the community. We may consequently infer the amount of food and rest which each condition requires. It is also possible to increase or lessen the needful quantity of food (within limits) with some degree of certainty; and we learn how much more costly the maintenance of soldiers must necessarily be in time of war than peace, and that of felons at forced labour than in idleness. We further learn how to lessen the wear of system arising from such exertion as the carrying of burdens, by reducing the speed at which they are borne.

These inquiries also enable us to account for the inability of many persons to make an ascent, except at the slowest pace, and for the great inequality in all persons between the effect of ascending steps and walking on level ground at the same speed. From his investigations and experience in Switzerland, the author believes that his views account for such accidents as the spitting of blood, which have occurred whilst ascending mountains, without reference to the degree of atmospheric pressure. This is, in part, independent of chemical changes, and is due mainly to the capacity of the lungs and trachea to receive a certain quantity of air in a given time, and of the heart and blood-vessels to carry on the current of blood, and especially to maintain a due relation between the pulmonic and systemic circuits. They also explain the conservative influence of dark rooms in eastern and southern climes, and of night in all climates. In like manner, they indicate the reason of the unhealthiness of buildings with deficient light—as prison cells, and many dwellings of the poor—and also of nervous persons living much in seclusion. It is probable that change of season varies the quantity of air inspired. Heated rooms lead to exhaustion indirectly, by increasing the activity of every function. Cold, when applied to the skin, increases respiration, whilst the breathing of cold air lessens the quantity of air inspired. Sleep and quietude are naturally associated with darkness and diminished activity of functions; and therefore wakefulness and labour at those periods of the day must induce more wear of system. Hence the ill effect of night labour. At the same time, the ease with which some persons pursue mental labour at night may be owing to the lessened vital actions at that period.

Breakfast seems to be the most important meal to the system, since it is taken after a long interval, and produces a greater effect upon the frame than any other meal. The effect of food does not pass away between the meals, or during the working day. Since a due relation between the respiratory function and the food supplied to the system is one of the most important problems of life, these inquiries are of great value, as they serve to prove how wisely our natural appetites lead us to a due combination of food, while at the same time they explain the ill consequences of what is termed "high living." Dr. Smith's interesting paper was accompanied by an extensive series of tables and curves illustrating his investigations.

LIGHTING OF A CORNISH TIN MINE WITH GAS.

A most important work has recently been in progress at Balleswidden Mine, near St. Just, Cornwall: the erection of gas-works, the introduction of gas into the shafts and levels, and, hence the superseding, to a considerable extent, of the old system of candles. Mr. Alexander Wright, of London, who contracted with the adventurers for the supply of gas, has recently been in the neighbourhood, and on Wednesday, the 8th ult., delivered a lecture to the agents and miners of Balleswidden on "Gas." A large audience assembled in the "dry," or drying-house, which we may state (for the information of distant readers) is a long, low building, having a tubular boiler the whole length of its centre, on which the wet clothes of the miners are dried, and which boiler is flanked by two rows of cumbrous chests, in which are deposited the men's materials, implements, &c. It is to the mine what the dressing, property, and green-rooms are to a theatre.

Mr. WRIGHT said it was now somewhat about twelve months since he happened to be at Penzance, engaged on professional business with the Penzance Gas Company, and carrying out some extensive alterations in their works, when his good friend, Mr. Colliver, suggested to him what an excellent thing it would be if the mines of Cornwall could be lit with gas. He stated that he had written to several gas engineers in London, who had expressed an opinion that it could not be done; it was impossible to send the gas down the mine. Well, he (Mr. Wright) came with Mr. Colliver to Balleswidden Mine, and made his first acquaintance with the life of a miner. He went down to the 110 fathom level, and examined the shafts, the levels, the tramways, and the workings. He went home and considered the matter very carefully, and came to the conclusion that he could light the mine. He sent a proposal to the proprietors of Balleswidden, who very liberally accepted it. He said "very liberally," because it always showed an enlightened spirit and a degree of liberality on the part of any set of adventurers to undertake or to patronise a new project; for, although it was quite true that the experiment had been wholly made at his expense, yet there was something akin to odium connected with a new thing, prejudices to be overcome, apathy to be encountered, and the adventurers of Balleswidden Mine having afforded him the opportunity of fairly combatting these, he should feel indebted to them to the last day of his life. As soon as ever his engagement with the adventurers was settled, his pipes were on their way to Plymouth, and ever since that time he had employed a gentleman, Mr. M'Pherson, on the work. Mr. M'Pherson had been very ably seconded, and all had been unremitting in their exertions, and had done more than he (Mr. Wright) thought possible in the time. He had now come down to inspect the work, and could pronounce that work highly creditable. It was an excellent piece of work, and he might say this without egotism, for it had not depended on himself. But especially was the work excellent when they recollected the perseverence that brought it about, by men who had never been in a mine before, who had worked up and down ladders in a way they had never been required to do before, and who had given no man offence. From the gentleman to whom he entrusted the supervision of the work down to his humblest labourer, all had kept on the best terms with the miners, and that was an auspicious commencement of this great work. He would not say that Mr. M'Pherson and his assistants had had no difficulties to encounter; it was not for him to say what those difficulties had been; he did not intend to trouble them with the scientific and practical difficulties which *had been* overcome. It was his intention now to meet them as one man should meet another: to endeavour to explain to them what his views of gas-lighting were, and to tell them at once that this lighting with gas was one of the best things for the miner, the practical working man, that could be adopted—if it was successful. If it could be made to succeed! Well, through his life he had met with many and various disappointments, but this had only taught him the value of earnestness and perseverance. Although not successful in all, he had been successful in some undertakings, and he would not easily abandon this, nor pronounce himself successful until his work was accomplished. Yesterday he was down in this mine, and examined all the lights, and he was quite satisfied, as far as the lighting of the shafts of the mine was concerned, and as far as the lighting of the levels and tramways was concerned, that it was a perfectly successful movement. One difficulty had yet to be overcome, and that was, to furnish them with a moveable light which the miner might hold in his hand, to enable him to pick the ore. That difficulty he had foreseen from the very first, and, three months ago, had tubes expressly manufactured for the purpose; when taken down they might not answer, and if so, he would have other tubes, until they said it would answer, and until they said gas gave as convenient, and a much better, light than a candle. A light equal to a candle would be no success to him; if he thought for one minute that the lighting of a mine with gas was only equal to the candle, he would abandon his plan to-morrow; if he did not think that gas itself was more wholesome to the miner, and would add years to his existence, he would also abandon it to-morrow. The health and life of a Cornish miner were as precious to him and his family as to any other man; and although the success of this enterprise might yield him fame and money, he would never allow either to interfere with a single day's existence of a living human being like himself. It was only necessary for them to say this gas is unhealthy, and to prove it, and to say it inconvenient, and to prove it, and he would abandon the plan to-morrow. Could he say anything fairer than that? It was a great pleasure and honour to him to be able to meet so many working men, and to be able to explain to them his views and intentions, for he relied mainly on them to carry out such views. What could he have done without the aid and assistance of those he had employed? and what would they have done but for the kindness of the miners? and he must continue to look to them—the first miners in Cornwall, and, consequently, the first miners in the world—for further assistance. Did they ever hear of such a firm as Bolton and Watt? In consequence of their inventions and improvements, and the knowledge imparted thereby to their workmen, each one of them became a foreman before 14 years were over. No new invention could be brought out but the workmen employed were elevated above their fellows. They attained a higher degree of knowledge, and could take their labour to a higher market; and, no doubt, could progress in the world. They could climb higher up the ladder; and it was one of the greatest pleasures any right-minded man could feel to see another raising himself by his talents and industry in the scale of society. And he held the principle, that every man who acquaints himself with an invention, raises himself somewhat in the scale; and not only in the moral and intellectual scale, but in such a way that he could wear a better broadcloth, and enjoy more of the comforts of this life. Thus, of every invention the working man enjoyed a liberal share. He had been a working man, and had toiled as hard as any man in this place; he knew the feelings and the aspirations of a working man, and he hoped never to lose them; and he assured them that every improvement effected in the commonwealth improved the condition and the prospects of the labouring classes. He trusted they would not think he had wandered from the subject. He should give a very brief history of artificial light from the beginning of the world to the present time; and then, more particularly, he would go somewhat into the science of the production of light itself—from the candle, oil, gas, and every other material from which we derive light; and, if he took the course he had laid down for himself, he would then say something as to the various uses to which gas had been put: after which he thought they would share in his astonishment that gas had not been previously introduced into Cornish mines. The history of artificial was an interesting subject to every man. Taking every part of the earth, and striking an average, we had 12 hours of light only out of 24. But the Creator had very fairly distributed his favours, and had also implanted in man the great means of progress, and of helping himself. He had placed certain elements before us, had ordained that certain intellects should play on those elements, and had decreed that the wisdom and experience of those who had gone before us should not perish; and that, our own glorious intelligence being brought to bear, we should by that experience and the exercise of our own ingenuity endeavour to imitate his great work. If we wanted additional light, the power of producing it was in our hands. At first sight, it would appear that every man ought to be acquainted with the nature and properties of light; how much more so the miner, who toiled deep in the bowels of the earth in darkness? He, above all others, was interested in the question of artificial light. He lives in an artificial darkness, and requires an artificial light to dispel the gloom. But every man is more or less interested in it: what would the life and employment of thousands be without light? What would their hours of enjoyment be without light? Night is to the day what winter is to summer, and though the summer day is pleasant for enjoyment, the winter night has its comforts too. When the toils of the day are over, the working man likes to sit by his fireside and see his family all around him; no moments are so precious as those, but what would they be without a good light? To miners this should be a subject of the deepest interest. Although he could talk scientific jargon as well as any man, he should endeavour to make every one understand what he meant. No real improvement in artificial light took place until the beginning of the present, or latter end of the last century, when, in Redruth, in Cornwall, a mine agent lighted himself about by a bladder of gas, and set an example which was soon followed, not only in England, but over the whole civilised world. It was

curious that a Cornishman was the first to adopt gas, and Cornwall the last to use it. Within a few miles of this place, gas was first manufactured by Mr. Murdoch, a mining agent, and yet Cornishmen were without gas in their mines to the present day. It seemed as if it was necessary that this great agent should be sent out, like a bird, to travel round the earth, and, after describing its circumference, to rest on the spot from which it started. When he looked at the light burning there before him, he could not help expressing his surprise at this. The words of an Irish poet occurred to him as applicable to this light—

"The best of all ways to lengthen your days,
Is to steal a few hours from night, my dear;"

for if you required a few hours from the night this was the most suitable light. The lights used by the nations of antiquity differed very little from those employed by the past generation. It was a curious circumstance, but, like many other facts taken from the Bible, was capable of verification, that the candlesticks used by the children of Israel differed little from those employed by the Greeks, the Romans, and the English. He could give them a perfect model of the seven-branched candlestick made by Moses, after he came out of the land of Egypt, for the children of Israel. In the following manner it had been preserved:—First of all, we read in the Bible of the manufacture of such a candlestick; then Solomon made ten like it, and placed them in the temple. When Jerusalem was sacked by the Romans under Titus, these candlesticks were still in the temple, and the Romans being in the habit of sculpturing representations of the sacred vessels they took from conquered nations, on an archway in Rome at the present day was to be seen an exact representation of Moses' seven-branched candlestick. By this we know that, from the beginning of the historical world down to the present time, a very small improvement had been made in lamps; for he could assure them that in the Shetland islands at the present time (and very probably in Cornwall) the lamps were very little indeed removed from this very lamp. They were open vessels, with a long slanting spout, in which were placed reeds for wicks. They were supplied with oil. From that time to the reign of Constantine the Great we read of very little except lamps. Although candles and candlesticks are mentioned, no doubt they were lamps of that description, such as are used in Turkey and the Levant at the present time. In the days of Constantine wax was used by the better classes. Little progress was made till about the 16th century, when the French turned their attention to the improvement of the lamp, which had always burnt with a long, smutty flame. Argand, a Geneva man, brought to Paris his Argand lamp, the improvement in which consisted in sending a stream of air up through the inside of the wick; such a lamp burnt better and without smoke. Little again was done until this Cornish agent, Mr. Murdoch, first shed a real light upon the world from the streets of Redruth in the year 1800. In 1813 Pall Mall was first lighted with gas. The largest pipe they attempted to lay down was one of five inches in diameter; now, he (Mr. Wright) had a pipe so large that a man could crawl up the middle of it. Not only is gas now used most extensively in public buildings, but it is applied to the arts and manufactures. If the production of gas was stopped in Birmingham, half the mechanics in the place would be thrown out of employ. [Mr. Wright here gave a humourous description of the travelling tinker of old and his soldering pot and irons, and explained that this description of pot was superseded in Birmingham by gas, the gas being now extensively employed in soldering button-nibs. He also gave a description of some work executed at Woolwich by Mr. M'Pherson, and his surprise one day at finding that, by means of flexible tubes, Mr. M'Pherson had conveyed the gas through the water to one of the floating hulks, which was amply supplied with gas to this day.] An immense amount of cooking in all large places was done by gas, and the gas was of so pure a kind, that the tenderest and most delicate dishes retained their natural flavour. Not one out of ten of the London chop-houses but used gas for cooking. Why, even the Mahomedans were now going to have gas: he did not know but that it was to be introduced into the harems. Surely the Cornish would not allow the Mahomedans to beat them in the march of improvement. Experience proved the superiority of gas, but he was now going into the scientific reasons of that superiority. It gave ten times the light for the same money; that was a great object. If they put all the candles they had at Balleswidden into one of his retorts, he could turn them all into gas, but they would not yield him so much money as gas, as they would as candles. He could make it much better from coal. Not a miner goes down a shaft but he carries a whole gas-work on his head—gasholder and everything else. A candle is a complete gas-work in itself. The light of the candle melts the grease, which goes up the wick, becomes converted into gas, and ignites. [Mr. Wright illustrated this by blowing out a candle and lighting the gas that still ascended from the wick, without touching the wick with a flame.] But there was this difference, he resumed, between the gas made from a candle and that made in a manufactory. Of course they knew that, in speaking as he was about to do, he had not the slightest feeling against any person at all interested in candle-making. A candle *was* a gas-work in itself, but it was a very lame one. It was an extraordinary thing, but Adam, the very first man who lit anything, was absolutely a gas manufacturer, just as much as we are at this present time. He made it and burnt it at once; we make it, *store it*, and burn it at our convenience. In a candle, the heat first melts the grease, which then becomes a kind of oil, and we see little billows of grease passing up through the wick; that grease then becomes converted into steam or gas. We have an interval between the time of making and using, and purifying gas; in the other case it is made and burnt at once. By the modern process, our gas passes through lime, which purifies it. Gas made in the old way had a certain portion of tar in it, such as he now produced in a bottle: now we had the means of purifying it. To prove to them not only that gas was as pure as the candles they burnt, but as pure as the purest sperm candle, he had here a little instrument of his own invention, used in nearly every city in England in which there is a demand for pure gas; and this he would explain, for the miner ought to know that the gas he burns is pure, and has a right to demand that it be made pure. The basis of all gas is hydrogen; the other component part is charcoal or coke. If he could get some charcoal and hydrogen, he could make pure gas. [With an instrument now before him, Mr. Wright explained his gas test. A portion of the gas then just manufactured was burning in a glass cylinder connected with a long tube. As the gas burnt, a drop of water was occasionally deposited in the tube, and was collected in a wine-glass which stood under the other end of the tube. This water was the product of the gas; it was pure and tasteless. Mr. Wright now also produced gas from water. He put a small quantity of vitriol into a large glass vessel half filled with water, and hung a small piece of zinc in a bell glass, which was placed, mouth downwards, into the larger vessel. He said both zinc and vitriol had something to do with the gas, yet it came neither from the zinc nor vitriol. Every atom of gas he now produced came from the water. He produced gas, but it was colourless; so he had to explain how that was the case.] He was now going to make an extraordinary assertion. No gas in itself could give light—a light was never produced from gas. This seemed a paradox, when they remembered what he said before, and involved the question of light as contra-distinguished from heat. If you heat gas to any extent you never get light, in order to produce which a solid substance must be used. [Mr. Wright now proved this by firing hydrogen gas. The flame was barely perceptible. But the insertion of a piece of platinum wire showed the flame, and its heat was seen by the wire quickly attaining a red heat. The lecturer further showed that the hydrogen or ordinary gas forms the blue part, or base of the light, hydrogen having the greatest affinity for the air; the white part of the light is the soot, or that which would become soot if not burnt. He passed a piece of polished steel through the blue part of a gaslight, and it continued bright—through the yellow part, and it was at once tarnished.] The same thing is observed while lightning passes through the atmosphere. When it lightens in a very rarefied atmosphere we get sheet lightning; in a denser atmosphere it becomes brilliant—the denser the medium the more vivid the light. The products of gas are water and carbonic acid gas. When a man burns a candle carbonic acid gas is evolved. It was just the same with gas; but a much less quantity of carbonic acid and water were thrown off, light for light, by gas than by candle. Gas was, therefore, not so deleterious as a candle, for there was less unconsumed smoke. Experience would tell them that the gas now manufactured in Balleswidden (which had been analysed and proved to be so) was as pure as the sperm candle he now held in his hand, and which cost 4d. How it would contrast with the candles they used he could not say, for he had not analysed them. [The lecturer now came to the subject of coal.] Mining in Cornwall was one thing—the miner went below and blasted the rock; in Staffordshire it was another thing; the miner dug up hugh masses of coal. Coal was the production of ancient forests, submerged for ages. In order to show them this he had brought two beautiful specimens of pieces of palm trees found near Newcastle; also some coal in the earliest stages of transformation, from which naphtha was made; specimens of leaves so pressed together as to form a sort of natural papier mâché; of Bovey coal (doubtful whether coal or wood); of Boghead cannel coal, differing from others in this respect, that it contains in every ton 1-3rd of coke, 1-3rd of gas, and 1-3rd of oil—oil worth 5*s.* per gallon—consequently the coal is worth £2 per ton; and of Wigan coal, that from which gas is principally made, as it is neither too rich nor too poor. The difference principally in all these coals is that one contains more coke than another. Welsh coal contains a large quantity of coke and a smaller quantity of gas; cannel coal contains a large quantity of gas and a very small quantity of coke. Naphtha is made from coal tar. Ammoniacal liquor is procured from the tanks of the gas-works. [Mr. Wright produced some, and its offensive smell occasioned much amusement. He then powdered some lime into the tumbler of ammoniacal liquor, and produced strong and agreeable "smelling salts."] In the course of further observations, Mr. Wright said one great thing had now been accomplished: he and the miners of Balleswidden, who were so mutually interested in this matter, had now met face to face, and knew something of each other; and he was quite sure he could depend on them to lend him every aid and assistance to carry this matter fairly out. He was quite sure it was to their interest, and certainly it would be a considerable favour to him, if he could secure their co-operation in this matter. This undertaking was a very arduous one—no man had attempted it before—and if he had not met with many friends here it would have been impossible to have carried it out. Any amount of perseverance on his part would have been futile without kindness on theirs. Gas was becoming a most valuable agent. The thing it would not do was hardly known (unless it was that it would not toast bread). There was no instance of gas-works having ever failed. If they had ever attempted to light a town, the attempt had never been abandoned. The gas movement was always an onward one—solely attributable to its superiority to candles—and he could not see why all the mines in Cornwall might not be lit with it. There were three reasons why gas was superior in mines—first, it gave a purer and better light than a candle; second, a steadier light; and third, the light from a candle could only be of a certain size; while a gaslight could be increased or diminished. He had been down into their mine. He thought it an act of great courage to go down those interminable ladders, although three captains very kindly accompanied him. And when he sat down at the bottom of one of the ladders, with one poor glimmering candle to illuminate the darkness, he really thought he had got into the other world. Let any stranger now go down and mark the difference. In place of the solitary light he could see the whole of the machinery illuminated, from one end of the mine to the other, and examine and rectify the minutest defect, or see the aspect of the mine. Any one who saw the effect of gas in a mine could not doubt for a moment of its success. In this he should be borne out by this meeting. Every working miner would attest that the lighting was successful in the shafts and in the levels. He would not say it had been successful in the workings, or that he thought it had been. Mr. M'Pherson, and one or two of the agents of the mine, would continue experiments, and if not successful the first day or week, difficulties would be overcome by perseverence, and they would persevere until they did succeed. Apprehensions existed relative to explosions of gas in the mine. Gas was not explosive except when mixed with air. Now, in the first place, all pipes and tubing would be subjected to careful inspection; and in the next, the ventilation of the mine was so good that any slight escape of gas would be directly carried up the shafts to the open air. If the largest quantity of gas he could manufacture in one hour were poured into the mine, such was the capacity of that mine, and such its excellent ventilation, that no damage would ensue. But, in spite of this, and the small chance of danger, he took every possible precaution. Every pipe in the mine was proved by steam at a high pressure. And then he had himself examined the pipes most closely, and in only one place—a mere pin's point—was there any escape. No doubt the men had smelt gas. It was necessary to join pipes, to blow foul air from them, &c., and during these operations small quantities of gas had escaped; but now no one who went into the mine could detect by smell that gas had ever been introduced. [By filling a gold-beater-skin balloon, and allowing it to ascend, Mr. Wright showed how rapidly gas escaped upwards, and he also showed an explosion of gas. Before ending his lecture Mr. Wright produced an apparatus for testing coal, which he said every mine agent and person engaged in purchasing coals (and, consequently, interested in their relative strength) should possess.] It was the invention of a friend of his, Lewis Thompson, Esq., M.R.C.S., one of the first chemists of the day. You take an average sample of coal, and pound it very fine in a mortar; you then mix it with a powder supplied you, chlorate of potass, of which 230 grains are mixed with 30 grains of coal, for the purpose of supplying oxygen to the coal during the experiment. Mixed well together, those ingredients are then deposited in a little copper vessel, and a fuse placed in it. The copper vessel is placed in a diving-bell. The fuse being lighted, the bell is submerged in a given quantity of water, the coal and potass rapidly burn, and the heat imparted to the water, as tested by a thermometer, shows the amount of excellence and strength possessed by the coal. Some coals yield 14° Fahr. during the ex-

periment, indicating that the total heat evolved from such coal is sufficient to boil off fourteen times its weight of water.

The following letter has been handed to us for publication :—

Balleswidden, Penzance, April 14, 1857.

A. Wright, Esq.

Dear Sir,

We were underground in this mine yesterday and examined your gaslights throughout, and have great pleasure in informing you that the lights are all burning exceedingly well—giving a good, bright, clear light. And, so far as it is tried in the shaft, levels, and pitch which was lighted yesterday, it answers exceedingly well, and we have no doubt of its answering all the purposes for which it is intended.

We find in the pitches in the ordinary way of working, one light in the centre of the pitch will be sufficient for four men to work with. But when more than one light is required the flexible tube will be quite sufficient to convey the light which may be required to any part of their work.

We remain, dear Sir,

Your obedient servants,

NICHOLAS TREDINNICK, Managing Agent.
WILLIAM CLEMENS, THOS. TRAHAIR, } Underground Agents.

ON AQUEDUCTS—ANCIENT AND MODERN.

LECTURE DELIVERED AT BURY ST. EDMUNDS, ON MARCH 24, 1857.

By G. R. BURNELL, Esq., C.E.

In his striking novel, "The Hunchback of Notre Dame," Victor Hugo makes the remark that "when we know how to observe, we may discover the spirit of an age and the phisiognomy of a king even in the knocker of a door." Perhaps Hugo has slightly exaggerated the importance of the mutual action and reaction between politics and the æsthetical expression of an age; and has applied a general truth in a case of detail which may be removed from the immediate operations of the law. But, unquestionably, the modes of thought and the social organisation of a nation are in no instance so apparent, or at least so distinctly recorded, as they are in the monuments connected with the supply of great social wants or with the manifestation of its religious feelings. The history of nations may, indeed, easily be read in their temples, their palaces, and their public works; and though the manner in which a water supply is effected may seem to give less scope for variety of artistic expression than the more elegant buildings of cities, it has really been treated by civilised societies with so many, and so distinctly marked varieties, that, perhaps, it may afford a subject for useful reflection,—to examine briefly the most characteristic systems which have been adopted in ancient or in modern times for the supply of that most essential article, water, to the great centres of population—to endeavour, in fact, to read the "sermons recorded by the stones" which have been thus employed.

During the patriarchal ages society was not sufficiently organised to admit of the execution of large works for obtaining copious distributions of water in situations remote from the natural sources of supply. Men were obliged, in fact, to go to the water, as they possessed few means of conveying it to their habitations; and the frequent allusions to the beauty of the water brooks, and the contests about wells, to be met with in that most poetical and beautiful of all histories, the Bible, may be referred to as illustrations of the importance attached by the inhabitants of the countries from which we originally derive our civilisation, to the possession of the means of obtaining that fluid at will. There is, however, nothing in the Bible to induce us to believe that machinery of any kind, as we usually understand the term, was used amongst the patriarchal tribes for the purpose of raising water; nor can any indications be discovered of the existence of any systematic irrigation amongst the Canaanites, or the Israelites at least. In Assyria, however, the Tigris and Euphrates were, at a very early period, made to contribute to the fertility of the land; and Semiramis is even said to have constructed an aqueduct for the purpose of supplying a purer water than flowed in the Tigris to her capital, Babylon; but no authentic description of this structure exists, of which I am aware. In Egypt many canals and artificial lakes, reservoirs, or channels, for storing the waters brought down by the periodical inundations of the Nile, were executed by the Pharaohs; but no attempts, on a grand scale, were made to secure a supply at a higher elevation than that attained by the river itself at the points of distribution, although the mural paintings of the Egyptian monuments certainly would induce us to believe that that remarkable people had already applied a rude kind of machinery, retained by their descendants under the name "Fadouf," for raising water to such heights as to secure an artificial irrigation of their fields. And, perhaps, I may here be allowed to observe that, in climates such as those which exist in Syria, Assyria, and Egypt, the effect of the intense heat of the sun upon vegetation directly, and social habits indirectly, is to concentrate attention more upon the means of effecting an artificial irrigation, than upon a municipal distribution of water; and we therefore find that in the East many extraordinary works have been undertaken for the purpose of effecting the former of these objects, whilst the latter has been singularly neglected in almost every country abandoned to the guidance of its indigenous rulers. The same remark may be applied to the countries which, in early times, fell under the sway of the Greeks, or which exclusively derived their civilisation from that brilliant but eminently unpractical race; nor was it until the Roman Republic had attained a considerable degree of power, and the mistress of the ancient world had increased greatly in population, that any advance in the science of municipal water supplies, beyond the resort to wells or to neighbouring brooks, was really effected.

"For the first 441 years from the foundation of the city, the Romans were content with the supplies of water derived from the Tyber, from wells, or from fountains," says Frontinus, in the commencement of his curious treatise "de Aqueductibus Urbis Romæ;" and he continues to say, that in his day the following streams were poured into the town through artificial channels: viz., the Aqua Appia, the Anio Vetus, the Aquæ Martia, Tepula, Julia, Virgo, Alsietina, Claudia, and the Anio Novus. The most ancient of these structures, the Aqua Appia, was undertaken by the orders of the Censor Appius Claudius Crassus, during the consulship of M. Valerius Maximus and P. Decius Murena, or in the year before mentioned, 441; but the waters were not brought into the interior of the town until about 40 years afterwards, in the year A.U.C 489. The aqueduct of the Anio Vetus was commenced at the instigation of M. Curius Dentatus, Censor, during the consulship of Spurius Carbilius and L. Papyrius, and was entrusted to the direction of Fulvius Flaccus, whose name may thus, perhaps, be considered as that of the first hydraulic engineer upon record. In the year A.U.C. 608, the continual increase of the town had rendered necessary an increase of the water supply, and the senate empowered Marcus Titius, Prætor, to execute a new aqueduct, called after him the Aqua Martia. In the year A.U.C. 627, the Aqua Tepula was brought into Rome; in 719, the Aqua Julia was added to the supply of the imperial city by the care of Agrippa, who also repaired the older aqueducts (for these do not appear to have been more solidly built, by the way, than many of our modern engineering-works), and 13 years after the completion of the Aqua Julia he likewise executed the aqueduct of the Aqua Virgo; for the astute minister of the successful destroyer of the Republic seems, like his modern imitators, to have thought it essential to provide for the supply of the physical wants of the nation, in order to divert their attention from the loss of their political liberties, and of their moral dignity. The Aqua Alsietina was also completed during the reign of Augustus; and even Caligula and Claudius, fierce, insane despots as they were, studied the public convenience in these matters so far as to commence, and perfect, the works required to bring into Rome the waters of the aqueducts known by the names of the Aquæ Claudia and of the Anio Novus. These respective aqueducts were brought from various distances by means of a series of works, to be generally described hereafter; and they arrived at Rome at different levels,—from which circumstance, and from their peculiar qualities or composition, they seem, according to Frontinus, to have been devoted to distinct purposes in the municipal arrangements of the capital of the Roman world. About the year 235, A.D., the Emperor Alexander added to the supply of Rome by the construction of another aqueduct, named after himself the "Aqua Alexandrina."

It is one of the characteristics of the old Roman, as indeed, it is to be assumed, of all despotisms, that its oppression was most severely felt by the upper classes of the capital; whilst the administration of the provinces was more just, and managed more with reference to the physical happiness of the subjected inhabitants than has been the case under the proconsular government of the times of the Republic. One effect of the imperial organisation, and of the execution of the elaborate system of internal communication in the early days of the Empire, was also to concentrate population around the seats of government in each of the countries submitted to its sway, or around the great military stations established for their protection. To such an extent, indeed, had the provincial capitals increased, or at least to such an extent did the Roman Government believe that it was called upon to study their wants, that we find executed in the provinces public works of the description we are now considering, which were often as magnificent and as important as those executed for the supply of the capital itself. It may be that the necessity for employing the soldiers during times of peace may have induced such men as Drusus to execute, by means of their labour, hydraulic works in excess of the immediate wants of the localities to be supplied; but even this excess must be considered to be a proof of the care of the central government, at the period of its greatest efficiency, for the wants of the provinces. Aqueducts were erected in Africa, Spain, France, North-Western Germany, Illyria, the Italian provinces, Greece, Asia Minor—everywhere in fact where agglomerations of inhabitants existed; and in many instances the Roman engineers displayed talents, and adopted processes for the distribution of water, of which they had given no indications in their operations conducted nearer home. The engineers, like the governors of the provinces, seem indeed to have risen in merit in proportion as they were removed from the depressing influence of the central authorities; but it is also worthy of notice that the taste, and even the manner of executing the technical details, of these works differed essentially from those which had prevailed during the independence of the various countries; so markedly had the Roman spirit impressed itself upon the populations submitted to its sway, and merged their civilisation into its own imposing unity. The Greeks, the Egyptians, and the inhabitants of Asia Minor, alike abandoned their national architecture to adopt that of their conquerors in the construction of their aqueducts and bridges, and, indeed, of all their public works.

The ancients were compelled, from the state of the science of applied dynamics amongst them, to obtain all their water supplies by gravitation; that is to say, they were compelled to resort to springs which rose at a higher level than that of the point of distribution, and were thence conducted by means either of channels, or of earthen, wooden, or leaden pipes; for they were ignorant of the means of applying the expansive power of steam, or the other natural motive powers, for the purpose of raising water from a lower level. It does not appear, I may also observe, either from Vitruvius, Pliny, Palladio, the anonymous author of the "Architecturæ Compendium," quoted by Poleni, or from Fabretti, that any systematic attempts were made to analyse the waters selected for town supplies; indeed, from the text of these authors, we are led to infer that the Romans had very rude and imperfect notions upon either the pathological or mechanical properties of water. It is true that Vitruvius mentions the effect of some of the streams of the Alps in developing the glandular swellings which constitute the remarkable disfigurement of the inhabitants of the Alpine districts of the Sardinian dominions, known by the name of the "goitre;" and that Pliny, and Hippocrates before him, had called attention to the different effects of water upon the cooking of vegetables; but the only practical rules which guided the ancients in their choice of a water supply, appear to have been those recorded by the anonymous author before mentioned, viz.—a species of rude synthetical observation of their effects. To quote his words, "When the springs flowed naturally, they," the ancient Romans, "observed whether the people who used them habitually enjoyed good health; whether their bodies were sound, their legs straight, their colour bright, and their eyes free from humours;" in which case the springs were considered to be pure and wholesome. "If, however, the springs were new, or the water were obtained from wells," he goes on to say, "you must take some of it and sprinkle it upon a bright bronze vessel, and, if it should not stain the latter, it will probably be good. Placed in a bronze vessel and boiled, if the water should not deposit any mud or sand, and if vegetables should be rapidly cooked in it, the quality may be pronounced good; as also it might be if the spring be perfectly clear, and without moss or other vegetable impurities, which is a sign of a perpetual and a pure supply." Our modern chemists would of course laugh at this simple philosophy, but I confess myself that I attach far more importance to the indications of the qualities of a water supply afforded by the state of health of the persons constantly using it, than I do to the results of a quantitative analysis; because, at any rate, the latter can only be exactly true for the precise quantity operated upon, and may differ essentially from the average quality of the spring; whereas the effect of the long-continued use of of water, upon that marvellously delicate analyser, the human constitution, must furnish a true criterion of its value.

However, the source of supply being determined, the spring-head, or the "Fons," was sometimes enclosed by the ancients with an ornamental margin, as in the case of the spring at Schapour, in Asia Minor; or if the springs contained any impurities, the waters were led into basins, called by the Romans "Piscinæ limariæ," in which, from the change in the direction of the current, the matters in suspension were thrown down. From thence the waters were conducted to the large towns, at least, by a "forma structili," or a "specus," a masonry channel; for the ancients do not appear to have used open cuts in the earth itself, like our modern canals, but always to have aimed at leading the water through covered and impermeable aqueducts, in the course of which wells, or settling pits, were placed to receive any deposits. A space of about half a foot was left between the top of the water

and the springing of the vault, or "fornix;" and "spiramenta," or visiting pits, were placed at regular distances to facilitate repairs, and to allow the escape of any air which might be carried forward. Sometimes a more elaborate description of structure than the ordinary "Piscina limaria" was introduced upon the course of the aqueduct, in order to secure greater purity in the water, or a species of filter, or "conceptaculum adaquas depurandum," similar to the example represented from the Aqua Virgo; and at the commencement of such works as the aqueducts of Evora, or of Lyons, small reservoirs, or "Castella," were placed. Very great attention was bestowed upon the construction of the "specus," in order to insure its durability and impermeability: and in almost every instance in which these works remain entire, they are found to have been lined with a coating of Roman cement, executed in the most superior manner. The "specus," was carried, wherever it was possible so to do, in positions which would admit of its being easily examined; but the Romans did not hesitate occasionally to execute tunnels, or to carry their watercourses upon lofty embankments. They gave a fall of not less than 6 inches in 100 feet; but in consequence of the windings or zigzags of their course, the waters of the Roman aqueducts never attained the velocity they would otherwise have acquired from that rapid fall. A great deal of ingenuity has been exercised by antiquarians to discover the motive for these frequent zigzags; but although, no doubt, they may occasionally be explained by the necessity for obtaining better foundations, I am disposed to suspect that they were rendered necessary by the conditions of the flow of the water in the channels. It must, indeed, be a subject of constant surprise to those who reflect upon the state of physical science in the ancient world, that the Romans should have succeeded to the extent they actually did in conducting large bodies of water from a distance. The sphericity of the earth was not ascertained in those days; levelling instruments were of the rudest kind; and the laws of atmospheric refraction were totally unknown. As the effects of gravitation were hardly suspected, the conditions of the flow of water, the science of hydraulics in fact, were a sealed book to the engineers of Rome; and all their knowledge of the subject must have been of the most empirical, rule of thumb description, and must have exposed them to sad miscalculations whilst it taxed their ingenuity to compensate for their errors—yet they *did* succeed in effecting their object. One serious inconvenience of their ignorance of hydraulics was, however, that their straight channels produced a greater velocity than was required, and no doubt it was in order to check this velocity that the Roman engineers made the stream take the abrupt changes of direction we may observe in their aqueducts.

It is in the manner of passing deep vallies that the greatest difference may be observed between the ancient and the modern systems of engineering, as applied to conducting large bodies of water. Indeed, so long as the aqueduct has only the inclination required to maintain a uniform velocity of the stream, the choice of the materials of which it shall be formed must be regulated by considerations of economy; and modern engineers would erect masonry, or brickwork culverts, or employ cast-iron pipes, as they found local advantages for procuring either the one or the other of those materials. The ancients, it is to be observed, were very little advanced in the metallurgic arts, and the use of cast-iron especially was to them totally unknown. This is strange when we reflect upon their skill in the management of wrought-iron, and in casting brass and bronze; but it is nevertheless the fact that they were compelled to use lead whenever they required a metal pipe, and even these pipes were made either with a soldered joint, or a kind of lip-joint filled in with a hard cement. Lead itself was in those days much dearer than it is now. And the remarkably skilful manner in which the aqueduct of Lyons was carried, by means of syphons, across a series of gorges, proves that the Romans generally resorted to bridge aqueducts rather than to syphons, when they had to traverse deep vallies, from motives of economy alone, not from any ignorance of the power of water to rise to the same level in both limbs of a syphon. At the present day these economical conditions are precisely reversed, and the construction of an aqueduct bridge, instead of laying down a pipe, would be a species of broad-gauge extravagance which could only be dictated by the desire to erect a monument.

The skill displayed by the Romans in the construction of the gigantic bridge-aqueducts, to be observed throughout their empire, was, however, of the most extraordinary description; and, notwithstanding our advances in the arts, those structures still challenge our respect and admiration. There are few objects, indeed, so striking as a long range of lofty arches, and the effect of the endless rows which stretch across the Campagna di Roma, interposing their dark outlines against the blazing sky, must be grand in the extreme. The aqueducts which supply the Eternal City are not, however, by any means amongst the triumphs of skill of Roman engineers, for they are not remarkably lofty, nor are they characterised by any perfection of mechanical execution, or by any boldness or elegance of design. The Aqua Claudia was the loftiest, and its arches rarely attained 100 feet; in Rome itself, both this aqueduct and the Aqua Virgo were ornamented in a monumental style; but in the country they were simply carried upon arches of brickwork of from 10 to 12 and 16 feet span, of one row, so long as the height does not exceed 60 feet, of two rows when that height is much exceeded. But it was the enormous magnitude of the supply, and the extent of the works undertaken, which constituted the real magnificence of these Roman aqueducts; and some notion of these claims for our admiration may be formed from the bare record that their total length was not less than 292½ miles, of which ⅞ were below the surface of the ground, and the remainder were upon embankments or masonry substructures, including nearly 29 miles upon arches, often 106 feet high. The *Aqua Appia* discharged its waters at a height of 27 feet 6 inches above the quays of the Tiber; whilst the *Aqua Anio Novus* arrived at the height of about 156 feet. The total quantity of water they supplied was said to have been 172,700,000 gallons per day, or more than double the quantity pumped by the Metropolitan Water Companies, according to the latest official returns; and it is to be observed, too, that this supply was entirely effected by gravitation, without the intervention of any machinery. The quality of these waters was far from uniform, and there was, therefore, made a distinction in their application. The *Aqua Marcia* was considered the purest and best, and was reserved for drinking purposes; the *Anio Vetus* was so foul as to be reserved exclusively for gardens. Truly, modern despotisms might take a lesson from the Heathen Romans in this detail of their municipal government.

Regarded merely as works of engineering, the aqueducts in the provinces were often of far greater importance than those of the capital itself; that is to say, that in their execution greater natural difficulties were overcome, and the details of construction were bolder and more original than those displayed in the water-works of Rome. The elegant structure over the castellum of the Evora aqueduct may be cited as an illustration of the attention paid by the provincial authorities to the decoration of these structures; and it may be interesting to state that it was erected at the commencement of a bridge consisting of 25 arches, each of about 13 feet 6 inches clear span, and 50 feet clear height under the key-stone, with piers 4 feet 6 inches wide. The width of the superstructure was 9 feet; and the engineers, in this case, adopted the very wise precaution of strengthening some of the intermediate piers, both longitudinally and transversely; the materials employed were a dark-coloured crystalline limestone and brick. At Merida, in Spain, the ruins of a magnificent bridge of three tiers of arches, represented in the drawing, are still to be observed; but the Segovia aqueduct also represented, which even now leads into the town the waters of a stream from the Sierra Fonfria, is perhaps the most interesting relict of the ancient masters of the world to be found in this country. It has a total length of about 2492 feet English, with a maximum height of 93 feet, divided into two ranges of arches in the deepest parts; the openings of the lower arches are about 11 feet 3 inches, and those of the upper tier are 13 feet 9 inches; and the whole of the works are executed in squared and dressed ashlar, set without mortar or cement. Near Toledo, and at Tarragona, there are to be found the ruins of other Roman aqueducts; near Cadiz, Talaveyra la Reyna, Castellon della Rana, and Granada, Moorish works of the same description are to be seen; but we may observe in passing that the modern Spaniards have neither maintained the ancient hydraulic works, nor erected new ones. Without dwelling on this point, I may observe, that the Pont du Garde, near Nismes, is the most beautiful and the most skilful specimen of Roman bridge-building extant, and some idea of its effect may be formed from the drawing on the wall. The aqueduct, with which it is connected, leads into the town the waters of the Eure and of the Airain, diverted from their natural course at a distance of about 25 miles; and it is carried across the deep narrow ravine, at the bottom of which runs the little river Gardon, by means of a bridge 879 feet long, and 160 feet deep from the surface of the water to the top of the culvert. There are three ranges of arches; the lowest, six in number, but of irregular openings (for the river arch is 88 feet span, whilst the others are only 63 feet 10 inches); and, as they are all semicircular, the springing of the larger arch is kept below the general line: the arches of the second tier are eleven in number, and, where over the lower ones, their axes correspond, and the span of the additional arches is made equal to the smaller ones of the first tier; the third tier is composed of a series of arches of between 16 feet 8 inches and 17 feet span, which are continued throughout the entire length. The height of the first tier of arches to the cymatium is about 66 feet; the second tier is of the same height, and the third 28 feet: the width between the faces of the work on the first tier is 21 ft. 6 in., on the second 15 ft., and on the third 12 ft.; so that a footpath was formed on each side of the set-off of the second tier of arches. The masonry is executed of large dressed stones, carefully bedded and jointed, but left with a rustic face; and the stone corbels, upon which the centres were carried, are still left. The conduit itself is executed in rubble masonry, lined internally with a coating of cement 2 inches thick; it is 5 feet 2 inches high by 4 feet 2 inches wide, and covered with flat stones 14 inches thick; but the depth of the water did not exceed 3 feet 4 inches. The fall of the aqueduct is about 1 in 2500. It is curious that the clear section of this channel has been considerably reduced in consequence of the deposit from the waters, which are highly charged by the bicarbonate of lime; and this example was much referred to by the engineers of the Roquefavour aqueduct, as a justification of so very equivocal a proceeding as the erection of such a work at the present day. I may add, that the Pont du Garde has been repaired and consolidated, and a roadway at the level of the first cymatium was added in 1745. The quantity of water it conveyed is said to have been at least equal to 8,316,000 gallons per day, in summer.

At Fréjus, Luynes, Oranges, Saintes, remains of Roman aqueducts are to be observed; and at Jouy, near Metz, some piers and arches, forming part of a structure which must have been 3700 feet long—more than half a mile—are still in place. The arches are in one tier, of about 17 feet 10 inches span; and the piers are 4 feet 5 inches on the face by 14 feet deep at the line of springing. This is one of the Roman remains in the province of Gaul whose precise date can be identified, for it was erected by order of Drusus, in the reign of Tiberius; the aqueduct of Nismes was erected by order of Agrippa; and the most interesting of the Gallo-Roman aqueducts—viz, that of Lyons—was erected by order of Claudius; the dates of the others are uncertain. It is said that Julian the Apostate executed an aqueduct for the supply of Paris, but it is hard to distinguish between his works and those executed by the orders of Marie de Medicis, at a much later period.

The aqueduct of Lyons was executed for the purpose of bringing into that town the waters of the Mount Pila, from a distance of 25 miles in a straight line, or about 40 in following the course of the channel; and about 8 miles in addition, of what may be called catch-water drains, were executed in the mountains. Where the conduit was formed of masonry, it was, as far as possible, sunk 2 feet below the surface of the ground. The bottom of the excavation was lined with a wall of small stones, set in a species of artificial cement, 13½ inches thick: the sides were of the same material, 20½ inches thick, and 5 feet 7½ inches high; and the whole was covered by a semicircular vault 13½ inches radius, and 13½ inches thick, rendered externally by a coating of cement, in order to prevent infiltrations, and covered with earth carefully rammed. The inside of the conduit thus formed was rendered with cement 6 inches thick at the bottom, 1½ inch thick up the sides to the springing of the arch, and with a roll of 3 inches radius in the corner. When the conduit was above ground, the side walls were made from 22½ to 27 inches thick, and were executed of dressed stone; whilst wrought iron ties were introduced every 2 feet 3 inches apart, to resist the lateral pressure of the arch. So long as the height of the substructure did not exceed 8 feet, the channel was supported on a solid wall; beyond that height it was carried upon arches; and as, in its course from the Mount Pila to Lyons, several deep gorges were traversed, there were no less than 13 of these bridge aqueducts, and 3 syphons, of very considerable dimensions. The first of these syphons is in the valley between the Soncieu and the Chaponest hills, about 2600 feet across, by 217 feet deep; the second between the hills of Baunan and St. Foy, about 3458 feet across, and 325 feet deep; and the third between St. Trenée and the gate of Trion, about 1700 feet wide, and of less depth than either of the others.

The water, upon arriving at the upper end of these syphons, passed through vanes which regulated the quantity to be admitted, in order to maintain a uniform head, which was usually regulated at from 22 to 23 inches. The reservoir on the Soncieu hill was 15 feet 2 inches long, by 4 feet 10 inches wide, by 4 feet 10 inches high, to the springing of the vault; the latter was semicircular, and had a man-hole for the purpose of facilitating access. The walls were of rubble, 2 feet 6 inches thick, faced with coursed masonry, and the inside was lined with cement as above described for the ordinary culvert; there were also two tiers of wrought-iron ties to resist lateral pressure. In the face wall towards the valley a series of nine openings were made, about 10 inches from the floor,

to receive the lead pipes; the dimensions of the openings being oval, 13 inches wide by 11 inches high, and spaced 7½ inches apart. In each of them were placed lead pipes 8⅞ inches diameter and 1½ inch thick, carried upon a species of substructure, represented in the drawing, so as to follow a regular inclination down and up the sides of the valley, and to overcome any irregularity in the outline of the ground. The pipes continued of the same diameter for one-half the descent, or about 81 feet; they then bifurcated into two smaller pipes, of 6 inches diameter each. These 18 pipes completed the descending limb of the syphon; they were continued over the bridge in the bottom of the valley, and they remounted the opposite side to a similar height, at which they were reunited into a series of 8⅞ inch pipes, to be thus continued to the receiving reservoir. In the level part, the pipes were laid upon carefully-constructed walls, with large stones at the elbows; they were covered with earth to protect them against frost, and tied to the sleeper walls by iron ties. Vent-pipes, for the relief of air, were carried to the upper reservoir: in the receiving reservoir the pipes were inserted at the top instead of the bottom, and the water was maintained at a height of from 2 feet 3 inches to 2 feet 6 inches. The perpendicular height of the Chaponest syphon in the highest limb is 164 feet, and in that of the lower, 142 feet 2 inches; whilst the maximum height of the Baunan syphon is about 282 feet; the latter starts from 12 pipes instead of 9. It was calculated by Count Caylus, in the beginning of the last century, that the lead of these remarkable works was worth about £500,000 at that time. What it must have been in the days of the Romans it would be hard to say; but altogether this work must be looked upon as the masterpiece of Roman engineering as applied to water supplies; and it affords a singular commentary on the parrot cry of authors of popular cyclopædias, "that the ancients were ignorant of the principle of the syphon"—an accusation, by the way, which no man who has read the 8th book of Vitruvius could for a moment entertain.

It would be tedious to record the numerous remains of aqueducts to be observed wherever the Romans established their sway; for the examples already enumerated suffice to convey a general idea of the state of hydraulic engineering in those days; and, indeed, the enumeration of the aqueducts would almost correspond with that of their principal stations, so great was the importance they attached to the supply of water. In England, however, very few traces of such works are to be discovered, perhaps because the towns were of small importance, or because the number of watercourses was such as to render the execution of great works, comparatively speaking, unnecessary. But, I would call your attention before quitting this branch of the subject, to the reservoir of Puzznoli, represented on the wall, which is as nearly similar to the best modern covered reservoirs as such a work can well be; and to the works executed for the supply of Constantinople, as indicating a peculiar phase of the Roman civilisation. No less than three aqueducts exist in the Valley of Bourgas, near that town; one of them is about 3000 feet long by 118 feet high in the portion over the river, and about 78 feet high in the other parts; it is in two tiers of arches, Gothic in form, 50 in the lower and 48 in the upper tier. The aqueduct of Justinian is also of two ranges of arches, 780 feet long by 122 feet high; and in another valley, upon the same line of aqueduct, near Pyrgos, is a longer one, with three elbows in its direction, one of which is at right angles to the original line: it has three tiers of arches, of irregular openings and intervals, and forms a sad contrast with the more elegant structures of an earlier period. Its total length is about 1000 feet, and its height 118 feet. There is also another ruined aqueduct bridge near Constantinople, which was destroyed, no doubt, during one of the wars of the lower empire; it was 884 feet long by 168 feet high, in two tiers, and the upper range has disappeared, being, however, replaced by one of the peculiar rude syphons used by the Turkish engineers, under the name "Souterazici," formed of earthenware pipes. But the most remarkable hydraulic works of Constantinople were the reservoirs; and some notion of their magnificence may be formed from the drawings exhibited. It may be added, that although the Turks have allowed these reservoirs to become choked with rubbish, they have maintained the efficiency of the water supply of their capital; and Andréossy stated that above 20,000,000 gallons per day were brought into the town.

During the middle ages the most extraordinary work executed for the supply of water to a town was unquestionably the aqueduct of Spoletto, attributed, but I believe very incorrectly, to Theodoric the Goth, for he reigned about 486, and died in 526, and the earliest date assigned to this structure is 741. It is unquestionably the boldest specimen of bridge building in existence, and the relative proportions of the piers and voids must always surprise the engineer; its mere height is fearful—426 feet—53 feet higher than the top of the cross of St. Paul's! whilst the perfection of the mechanical execution and the style of architecture are equally worthy of notice, if this marvellous structure be really of the date above stated. A great aqueduct was erected at Pisa about 1606, containing no less than 959 arches, of about 15 feet 3 inches opening, and 40 feet high. At Civita Castellana, in the middle ages, at some unknown period, the extraordinary monument represented on the wall was erected. The aqueduct of Arcenil was built about 1621. Vauban's gigantic project was commenced about 1680. Vanvitelli's gigantic work was commenced about 1753; and the Lisbon aqueduct was completed by Manoel da Maya in 1732. In numerous other situations similar works were undertaken, but they were entirely modelled upon the Roman system—viz., the use of covered channels, either sunk in the ground or carried upon a masonry substructure; nor was any difference attempted to be introduced in the mode of conducting water supplies until Sir H. Myddleton, and the unknown author of the Plymouth Cat, executed those open channels by following the natural levels of the ground—a decided step backwards in the art—or until the engineer of the Ponte delle Arcate, of Genoa, made the first application of cast-iron pipes upon a syphon bridge. The old water-wheels of London Bridge, of the Pont Notre Dame of Paris, and of Marly, were amongst the earliest essays, upon a large scale, of the system of raising water for a town-supply by mechanical means; and the great aqueduct bridges executed in France, our own country, and America for the various navigable canals, gave indications of a desire on the part of modern engineers to shake off the trammels of the Roman traditions. Telford was the first to use cast-iron plates in the execution of the troughs of his aqueducts—a system since applied by Mr. Leather, of Leeds, upon a very much bolder scale; the Americans applied timber for the same purpose with equal hardihood and equal success; whilst the Guétin Bridge is executed with a mechanical perfection and a boldness of conception, when the volume of water, the span of the arches, and the construction of the locks are considered, which surpasses anything which has survived from the ancient world. Latterly, it has been proposed to execute large channels for the conveyance of water, in the manner of the Menai Tubular Bridge; and, indeed, the improvements in the art of bridge-building generally have been made subservient to the effecting the great object of directing water to the desired points of distribution.

The great distinction between the aqueducts of the ancients and of the moderns, however, consists in the application in the latter of pipes of large dimensions, laid at a small distance from the surface of the ground, and following all its variations of level, without any serious attempts to modify the irregularities encountered. The steps by which this change in hydraulic science have been achieved have been taken very deliberately, and very recently; and perhaps have been as much advanced by the improvement in the metallurgic arts, and the consequent economy in the manufacture of the pipes, as they even were by the practical results obtained by the constructors of large pumping-engines. Indeed the whole of the conditions of a town water supply are, at the present day, essentially different from those which formerly prevailed; for, instead of its being now an indispensable condition that the water should flow by gravitation, it has become simply a matter of question, or of comparative estimate, whether it would be cheaper to pump the water from a lower level than to lead it from a distance by gravitation. The mode of constructing the conduit, too, has simply resolved itself into a question of money, and the engineers of the Croton aqueduct, no doubt, were guided by their calculations of cost, when they resolved to execute that work in masonry, for the greater part of its length, instead of using cast-iron pipes, as they eventually did in the New York Island itself. I am at a loss to account for the execution of the immense aqueduct of Roquefavour, for the supply of Marseilles, and, indeed, am inclined to look upon it somewhat in the light of a sublime folly; for there are syphons actually executed, or pipes have been laid in depressions, creating a pressure of even greater extent than would have existed here. The actual difference of level between the highest and the lowest points of the pipes in the new Liverpool water-works from the Rivington Pike is about 311 feet 6 inches; whilst the maximum height of the Roquefavour aqueduct is 266 feet. On the Lock Katrine line of pipes the maximum depression of the pipes in one of the vallies is 207 feet; so that the practical difficulties in the way of executing syphons of these extraordinary dimensions must be considered to be solved, and the mode of conveying water, whether by gravitation or from a pumping-engine, ought only to depend upon local considerations of economy. In England, and I suspect in all civilised countries, a cast-iron pipe, unpoetical, unromantic, unsublime, though it be, will now always be found to be cheaper than any masonry culverts; whilst, in cases where the water flows under a great pressure, they are preferable to stoneware pipes on the score of impermeability, and of the more effectual manner of making the joints. Wood pipes have, of course, been long abahdoned; lead is far too costly, although the improvements in the manner of making lead pipes have obviated this objection to some extent, and those connected with the longitudinal seams—the great Roman difficulty—entirely; and, I may add, that wrought-iron pipes are objectionable for large town supplies, precisely on account of their malleability. It is not probable, therefore, that in works hereafter to be executed, the same artistic decorations will be lavished upon the means by which water is to be carried from one hill side to another as we have observed in the works of the Romans, or of the moderns, who have not advanced beyond them in engineering science. The experience of the Liverpool and of the Glasgow works is conclusive on this subject; and we may be sure that no reasonable English engineer would now erect an imposing aqueduct, but would simply lay a pipe under the valley. We loose perhaps in poetry of art what we gain in economy; but are thus enabled to devote more attention to incur greater outlays, in order to secure a pure and copious supply. There is indeed more skill, more of engineering contrivance, require to compensate the mill owners and to preserve the efficiency of their factories upon the banks of the streams which supply the Liverpool and Manchester water-works than enters into the erection of a bridge-aqueduct, be it ever so lofty. The one is, however, patent to all the world; the other can only be felt by the mill owner, or by the practical engineer; and is therefore overlooked by the public in general. But the operations rendered necessary for the supply of some of our large towns are so enormous, and so characteristic of the state of the science of hydraulic engineering at the present day, that perhaps I may be allowed to state briefly the leading characteristics of the works executed at London and Liverpool, and of those in progress near Glasgow.

London itself, like Rome, was for many generations supplied entirely from the wells and conduits fed by the waters contained in the superficial gravels and sands overlying the dark blue clay, or from the little rills which flowed from the hills around; but even in the reign of James I. the population had increased to such an extent, that Sir H. Myddleton was induced to execute the New River, for the purpose of bringing into the town the waters of some springs which rose to the surface at a considerable elevation above the city, and upon the eastern side of the valley of the Lea. This mode of obtaining a supply from a distance, and by gravitation, corresponded with the practice of the Romans; but Sir H. Myddleton either could not find workmen sufficiently skilful to imitate the great works by which the ancients shortened the course of their aqueducts, or, perhaps, he was guided by motives of economy; for instead of crossing the vallies he encountered, by bridges he developed the course of his aqueduct, upon what are technically known as the "contour lines" of the country; so that the water from the Amwell springs, which are situated at a distance of about 19 or 20 miles as the crow flies from St. Paul's, were actually made to flow a distance of 39 or 40 miles before reaching the Clerkenwell reservoir, in a channel about 18 feet wide by 4 feet deep, and having a total fall of 16 feet in its length. The New River was, in fact, a bold undertaking for the time and country of its execution; but it was a very rude one, and inferior even to the aqueduct of Arceuil, executed about the same period in Paris. It sufficed, however, for the supply of London for some years, and the next step seems to have been to establish a water-wheel in one of the arches of old London Bridge. Then, about the end of the last and the commencement of the present century, the Chelsea, Lambeth, Vauxhall, West Middlesex, East London, Grand Junction, Kent, and Hampstead Companies, were established, all of which, except the two latter, derived their waters from the Thames within the influence of the tide. So much fault was, however, found—and very justly so, too, be it observed—with the water supplied by the London companies, that in 1851 the whole system was revised by Parliament, and shortly afterwards the works were commenced which enable Londoners to boast of what I firmly believe to be the best water supply of any city in the world. None of the water is now derived from the rivers in the portions affected by the tide; all of it is filtered, excepting the insignificant quantity supplied by the Woolwich Company, and that does not require any such process; no portion of the distributory works are exposed to the atmosphere, and many precautions are taken to prevent contamination of the sources of supply. The quantity distributed by the water companies is said to be, on the average, above 81,000,000 gallons per day, and it is also said that about 20,000,000 gallons are supplied by the deep and the shallow wells of the metropolis. The aggregate nominal steam-power employed by the companies alone is estimated at 7254 horses; and their total capital is admitted by the government inspectors to be about £7,102,823. More than 51,000,000 gallons of the above quan-

tity is pumped from the Thames near Kingston or Hampton; and, though we cannot boast of our aqueduct bridges, we may cite with pride the fact that there are above 2000 miles of mains laid down for the distribution of our water supply, and that the whole of these gigantic works have been executed by the resources of private enterprise. This last fact has, indeed, produced one remarkable difference between the water supplies of London and of such cities as Rome or Paris, where the State has interfered, to which it may be as well to call your attention. It consists in the profuse display of water for ornamental purposes—as in fountains, jets, &c., in the latter, and the total absence of such works in our own capital; but as a compensation it may be mentioned that neither in Paris nor in Rome does a domestic supply exist, and the water used by the poor is bought at so much per pail.

At Liverpool a considerable portion of the water supply is obtained by pumping from a series of wells in the new red sandstone; but the quantity so obtained is much below the real wants of the town, and its quality is far from satisfactory. There are no fresh water rivers near Liverpool, nor are there any sources from which a natural supply could be obtained nearer than the Welch hills near the Bala Lake, from which, indeed, it was once proposed to conduct the water to Liverpool. The corporation, under these circumstances, have lately carried into effect some of the most gigantic works yet executed for creating an artificial source of supply, founded upon a system already used for navigable canals, and for mills especially, in the North of England. This system consists in forming reservoirs for the purpose of storing the rain-waters, which fall in excess at certain periods of the year, for distribution in dry seasons; it regulates, in fact, the disposal of the rainfall. It would be out of place, perhaps, were I now to attempt to explain the details of these works, and the advantages and disadvantages of the system; but I may state that their success depends upon the freedom of what is called the gathering ground, from peat or mineral substances able to effect the qualities of the water; the mode of constructing the reservoirs, and the area and cubical contents of the latter; for most of you will at once appreciate the difference between lake and pond waters. The district from which the town of Liverpool obtains its new supply is situated in the hills near the Rivington Pike, which are about 1200 feet above the level of the sea, and about 30 miles from the town; and the waters are collected from an area of about 10,000 acres of a millstone grit deposit, said to be remarkably free from peat. There are some compensation reservoirs formed for the supply of the mills seated upon the lower parts of the streams intercepted, and some immense artificial lakes for the supply of the town, whose collective areas are not less than 600 acres, or very nearly a mile square, and whose contents are not less than 3,156,000,000 gallons. Immediately below the last of these storeage reservoirs are formed a series of filter-beds, and the water is led from the latter through some 44-inch cast-iron pipes directly into the town, dipping in its course no less than 311 feet 6 inches below the level of the inlet from the filter-beds.

Works of equal magnitude to these Liverpool ones have been lately executed upon nearly the same system for Manchester, Bolton, and other towns in the manufacturing districts of Lancashire and Yorkshire; but those lately commenced for the supply of Glasgow are those which seem to me to be the most interesting on account of the historical associations with the locality in which they are situated. The corporation of Glasgow have, indeed, resolved to derive an increased supply of water for their continually extending town from the lovely Loch Katrine - the scene of Sir W. Scott's Lady of the Lake—so powerless are the haunts of nature, or the poetical associations of former days to resist the advance of utilitarianism. Think of the fair Helen pulling up a sluice, or of the Græmes looking after a tumbling bay! but when 500,000 souls are assembled in one town, water must be had, and so the poetry of these dells has been destroyed. Glasgow is fortunate in possessing thus a natural storeage reservoir, for the waters flowing from a district of 30,000 acres, which is itself of about 2500 acres in area, or four times that of the Liverpool lakes; and from it the water is brought to the banks of the Clyde—a distance of about 25 miles—by means of a pipe, occasionally laid in tunnels, but, generally speaking, following the natural variations of the surface of the ground. In its course, this pipe is carried through vallies, in which the differences of level are as great as those formerly considered to render inevitable the construction of huge bridge-aqueducts; but these useless monuments have been avoided; and the agency for conveying that necessity of modern and ancient civilisation in their highest expressions—a copious supply of water—is unseen, and almost unknown.

In conclusion, I would observe, that in comparing the systems formerly adopted, and those now used, for conveying water to great distances, we must always bear in mind the principle that engineering is essentially a science of expediency,—that is to say, that it is the duty of the engineer to adapt the means he employs to the end to be obtained; and that he is forced to deal with external circumstances as he finds them. The Roman engineers adopted the system which must, all things considered, have been the most economical in their day; for they could not raise water artificially, in the manner that we have been enabled to do by the improvements in the pumping-engines; and the price of metals must formerly almost have compelled them to resort to masonry channels rather than to pipes. The mystery indeed is, rather, how the Lyons syphons ever came to be executed—not that the ancients so seldom applied the law of hydraulics, on which their action depends. It may even happen in some places at the present day, that masonry culverts, or stoneware pipes, may be cheaper than cast-iron ones, especially when water flows by gravity. These are questions of detail, and must be decided by local considerations—just as the Americans use timber for the construction of their canal aqueducts where we use cast-iron, or the French, stone. But we may be sure of this, viz.: that the days for the construction of surprising works of art have passed away, never to return; and that such structures as the Roquefavour aqueduct must mark the last stage in the history of the *monumental* structures for the purpose of a water supply. We look, now-a-days—and very properly—too much for a dividend upon our capital to waste it in structures of questionable utility.

COOKING BY GAS.—Mr. N. Defries, the gas engineer of Regent Street, has recently been engaged by the proprietors of the Wellington, St. James's Street, in converting a splendid breakfast room, on the first floor of that establishment, into a kitchen. The apparatus which he has constructed for the purpose is adequate to the preparation of a dinner for five hundred persons by the use of gas alone, and is an elaborate piece of work, though of a singularly neat and compact appearance. It occupies the centre of the room, and is so admirably arranged that every noxious product generated by combustion is effectually carried away, and a wholesome atmosphere preserved during the process of cooking. At a dinner given by the proprietors last Thursday week, over which Lord William Lennox presided, the merits of the apparatus were frankly acknowledged, and the manufacturer of the apparatus warmly complimented on the success of his undertaking.

GAS STEALING AT BRISTOL.—Thomas Collings, a person of respectable appearance, and who lately carried on business as a tin-plate worker at Bedminster, was found guilty at the last Bristol Quarter Sessions of having stolen 1000 cubic feet of gas on the 4th of February last, the property of the Bristol United Gas Company. The Recorder sentenced the prisoner to three months imprisonment.

NEW GAS COMPANY AT MATLOCK BATH.—In pursuance of a requisition from a number of the inhabitants of Matlock, Matlock Bridge, and Matlock Bath, a preliminary meeting was held at the Queen's Head Inn, on Wednesday, for the purpose of forming a company for supplying the above-named places with gas. J. C. Newbold, Esq., was unanimously called to the chair, who explained to the meeting the mode of forming these companies, and remarked that the expenses attending such formation would now be less than they were when the Matlock Bath Gas and Coke Company was formed, as by the Joint Stock Company's Act of 1856 no deed of settlement was now required. The chairman had no doubt but the existing company, having plant sufficient, would be willing to supply gas from their works, if the proposed company should deem it expedient to pursue this course. He proposed to raise a capital of £1000 by 200 shares of £5 each, with limited liability, but should it at any time appear advisable to increase the capital for the purpose of erecting independent works, or any general purposes, the Act quoted gave powers to do so. The meeting was called at an inconveniently early hour, which, doubtless, accounted for a somewhat slender attendance in point of numbers, but the object sought to be obtained, namely, the formation of a company, was realized by 96 shares being taken by those present. A vote of thanks to the chairman concluded the business.—*Derby Reporter.*

IPSWICH.—The Ipswich Philosophical Society recently held a meeting in the library of the Museum—W. H. B. Webster, Esq., President, in the chair; when a paper was read on "Artificial Light, and the Usual Modes of Obtaining it," by E. Goddard, Esq. After briefly describing the nature and prin-

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Average Weight of Cast-Iron Gas-Pipes, per Yard.

1¼ in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lbs.

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	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Pig Iron, No. 1	4 10 0	3 15 0	3 12 0	4 0 0	4 10 0
1¼ and 2 inches Socket Pipes	8 0 0	7 5 0	7 10 0	7 15 0	7 10 0
2½ and 3 " " "	7 10 0	7 0 0	7 5 0	7 10 0	7 5 0
4 and 5 " " "	7 10 0	6 15 0	7 0 0	7 5 0	7 0 0
6 in. & upwards " "	7 5 0	6 10 0	6 10 0	7 0 0	6 10 0
Retorts, 1st fusion, hot blast	7 0 0	...	7 0 0	7 5 0	7 0 0
" 2nd " cold "	8 0 0	...	7 5 0	7 10 0	7 5 0
Tank Plates, ¼ thick and above	7 10 0	6 15 0	7 0 0	7 5 0	7 0 0

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NEWCASTLE.	s. d.		SCOTCH CANNEL.	per ton.
Unscreened.			Boghead, at Leith	32s. 0d.
Whitwell Primrose, Burnhope	6 6	per ton	Kirkness, best	23 0
Pelton and Medomsley	7 0	"	Capeldrae, 1st quality	20 0
Pelaw	7 3	"	" 2nd "	12 6
Eighton Moor, New Pelton, Peareth, South Pelaw, Washington Hutton, & South Peareth	7 6	"	Lesmahago, at Glasgow	25 0
			" " Leith	27 6
			Arniston	22 0
			Wemyss	20 0
			Knightswood	18 0
Ramsay's Newcastle Cannel	15 0	"	Methill	13 0

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Best Newcastle fire-bricks	60s. per 1000	Welch bar iron, in London	£8. 15s. per ton.
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Cliff's fire-bricks at Wortley, 57s. 6d. p. 1000		English block tin	£142 "
Tough cake copper	£126 per ton.	Banca " "	£147 "
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	2 inches.	1½ inch.	1¼ inch.	1 inch.	¾ inch.	½ inch.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent welded tubes, from 2 to 12 feet, per foot	1 8	1 0	0 10	0 7	0 5	0 4½
" " " 6 in. to 18 in., each	3 0	2 0	1 9	1 3	1 0	0 9
Connecting pieces, or long screws	3 6	2 3	2 0	1 6	1 2	0 11
Bends, springs, and elbows—wrought iron	3 9	2 3	1 9	1 0	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 10
Crosses, wrought or cast	4 6	3 0	2 6	2 0	1 6	1 2
Iron cocks	17 6	9 6	7 6	4 6	3 3	2 6
" with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing sockets, caps, plugs, and nipples	1 3	0 9	0 8	0 6	0 5	0 4
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2 quart	15 0	14 0	13 6	13 0	12 0	

FREIGHTS, per Ton.

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Chatham & Roches- [ter	6s. 6d	Boulogne	8s. 0d
Cork	9 6	Barcelona	27 6
Dover	7 0	Bordeaux	16 6
Dublin	10 3	Cadiz	19 6
Exeter Quay	9 0	Calais	8 0
Folkestone	7 0	Dieppe	9 6
Hastings	7 6	Genoa	27 0
London [mouth	6 6	Hamburg	9 6
Lowestoft & Yar-	4 3	Havre	10 6
Lynn	5 0	Leghorn	28 6
Portsmouth	8 0	Lisbon	18 0
Plymouth	8 0	Rotterdam	8 3
Whitstable	7 0	Stettin	12 0
Weymouth	8 0	Trieste & Venice	30 0

ciple of the combustion of oil, tallow, and wax, by means of the ordinary wick of the lamp or candle, acting by capillary attraction, and keeping up a continuous supply of fuel to the flame; being, in fact, a gas-works in miniature. Mr. Goddard sketched the history of the manufacture of carburetted hydrogen gas, and its first application as an interesting scientific toy in the hands of the philosophers of the last century, down to its widely-extended uses of the present day for the purposes of heat and illumination. He observed, that the most important desideratum to be obtained in the successful application of gas is to encourage its consumption, so as to give a maximum amount of light at a minimum expenditure. To arrive at this end many schemes were adopted and patented by different inventors. Several burners of different dates, and ingenious construction, were exhibited; the most successful of which appeared to be the duplex argand burner, recently invented and patented by Mr. Goddard, which is a simple modification of a steam-engine slide valve, adapted to the delicate and instantaneous regulation of the supply from a small taper flame to the powerful argand burner. The singular effect of carbonic deposit, resulting from imperfect combustion, by the aid of a burner constructed for the purpose, was shown in the form of beautiful scintillations, assuming an infinite variety of brilliant gyrations, resembling miniature fireworks. A large mass of sulphate of ammonia in crystals, under a glass case, was placed upon the table. This substance, which is becoming of vast commercial value as an artificial manure, is obtained by evaporating the refuse ammoniacal liquor of the gas-works, which formerly was, and even is now, thrown away as an useless article by some companies. At the conclusion of the paper, Mr. Webster proposed a vote of thanks for the interesting information Mr. Goddard had imparted, to which the meeting unanimously and cordially responded—*Suffolk Chronicle.*

SEWERAGE OF PARIS.—The Prefect of the Seine has just presented a report to the Municipal Council of Paris on the subject of a large tunnel-sewer, to be formed in such a manner as to carry off the water which in rainy seasons inundates some quarters of Paris, particularly the Faubourg Montmartre, Rue de Provence, Chaussée-d'Antin, and neighbourhood. The document states that the surveys which have been made clearly establish that the very slight fall of the river at Paris, where, in fact, the bed of the Seine is nearly on a level, renders it impossible to prevent the waters, when high, from flowing up into the sewers. When the river is at a height of 3 mètres 70 centimètres, the water runs up into the sewer of the Rue de Rivoli as far as the Place du Palais Royal, and completely stops the service of the sewers, particularly that of the fountains of the Place de la Concorde. When at a height of 5 mètres 25 centimètres, it flows up as far as the Rue St. Denis. The Prefect states that, in presence of these facts, he conceived the idea of turning to account the bend in the river, which about Asnières approached near enough to Paris to serve as an outlet for the sewers of the quarters on the right bank, about two mètres lower than the grand sewer which runs into the Seine at Chaillot. The report then goes on to describe this new sewer. "It will start," it says, "from the bottom of the Rue Rumfort, at its junction with the Rue de la Pépinière, run to the Place Laborde, and follow the Rue Malesherbes to the Barrière de Monceaux, and thence to Asnières. A communication may be immediately made under the Rue Rumfort with the large sewer which runs to Chaillot. By hereafter prolonging this sewer to the Place de la Concorde, by the Boulevard Malesherbes and the Rue Royale, the Rivoli sewer and almost all those of the right bank may be connected with the new one. Another branch, which it will be desirable to commence without delay, would run along the Rues de la Pépinière, St. Lazare, Lamartine, Montholon, Papillon, and Paradis, and even, if necessary, as far as the Canal St. Martin. This line would receive the water which so frequently causes the inundations above alluded to. The expense of this undertaking, which is of the greatest importance to the health of Paris, is estimated at 3,480,000 f. This sewer would, within Paris and as far as the fortifications, form a tunnel, and beyond them be made by a covered cutting. The width of the sewer is proposed to be six mètres, and high enough for boats to pass. One of the causeways at the side will have rails laid down for waggons, by which, hereafter, a general system of carrying off the soil from the water-closets in Paris may be established." Three years will be required for the complete execution of the whole of this work; and, as it is desirable that it should be commenced immediately, the Prefect concludes his report by proposing a credit of 1,200,000 f. for the first year's operations.

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WHARF ROAD, CITY ROAD, LONDON.
Mr. PENNY begs to inform Gas and Water Companies that he undertakes the erection of new, or the alteration of existing, works; and that he may be consulted generally on all matters connected with gas and water supply. He is also prepared to supply best Cold-blast Retorts, Socket-Pipes, and Connections, Iron Borings, &c. &c., and all the necessary Castings used n Gas and Water-Works.
*** Country orders executed with care and despatch.

WALTER MABON, Engineer,
ARDWICK IRON WORKS, FAIRFIELD STREET,
MANCHESTER,
Manufacturer of
IRON TANKS for Gasholders, Railway Stations, &c.
GASHOLDERS.—Extensive premises at Gorton, solely for the manufacture of Gasholders, and other heavy Wrought-Iron Structures.
GAS APPARATUS.—W. M. has an extensive assortment of patterns for Purifiers from 4 feet to 15 feet square, also round ones from 4 feet to 10 feet diameter; Scrubbers, Condensers, Washers, Columns, Girders, and Tripod Patterns, suitable for Gasholders, from 10 feet to 150 feet diameter, either Single-lift or Telescope. Contractor for Gas Works of any Magnitude. Designs, Specifications, and Estimates furnished.
WROUGHT and CAST IRON ROOFS for Railway Stations, Gas Works, Warehouses, and Sheds, prepared for Slates or for Corrugated Iron.
IRON HOUSES, either for Dwellings, Manufactories, or Public Buildings.
PIPES and VALVES, for Gas and Water, from 2 inches to 48 inches bore.

WHITEHOUSE and CO.,
GLOBE PATENT TUBE WORKS,
WEDNESBURY,
Beg to draw the attention of Engineers and Managers of Gas Works to the superior quality of the Article they manufacture, both in respect of the iron employed, and the perfect manner in which it is welded; in proof of which they can refer to the testimonials of the most eminent Gas Engineers, and the experience of the principal of the large Gas Companies of the kingdom.
Orders promptly executed.

RETORT AND BOILER SETTING.

FREDERICK SIMMONDS, Sen.,
No. 19, YORK STREET NORTH, HACKNEY ROAD.
Thirty years RETORT SETTER to some of the leading London and Provincial Gas Companies, to whom he can refer, begs leave to draw attention to his economical mode of Setting Clay or Iron Retorts, &c.
F. S. will engage to provide all materials and labour, or labour only.

HARRIS AND PEARSON,
PROPRIETORS OF
BEST CLASS-HOUSE POT AND CRUCIBLE CLAY
MANUFACTURERS OF
FIRE BRICKS GAS RETORTS, &C.
AMBLECOTE FIRE CLAY AND BRICK WORKS,
STOURBRIDGE.
Late in the occupation of I. and W. King.
Originally J. Pidcock, Esq.

PATENT FLEXIBLE GAS TUBING.

JAMES LYNE HANCOCK'S Vulcanized Indiarubber Hose Pipes and Tubing. Manufactory (and Warehouse), Goswell-mews, Goswell-road, London.
Gas Companies, Engineers, Gas Fitters, and the Trade generally, are respectfully informed this Tubing is now manufactured to any size, from ¼ inch bore and upwards, in 100-feet lengths, and perfectly cylindrical, either with or without a spiral wire inside.
VULCANIZED GLAZED FLEXIBLE TUBING, from ¼ inch up to 1 inch diameter, made in 24-feet lengths; or, covered with silk or worsted, up to 100 feet.
VULCANIZED HOSE, for FIRE ENGINES, BREWERS' USE, and for standing great pressures, (Rubber and Cloth combined), made to any length or size to fit the necessary screws, &c.
VULCANIZED INDIARUBBER AIR-TIGHT BAGS, made any size, for Gas Mains, with flexible tubes attached, and fitted with stopcocks complete.

EDWARD RUSSELL,
ALMA TUBE WORKS,
WALSALL,
Manufacturer of Patent Welded Wrought-Iron Tube for Gas, Steam, and Water. Wrought and Cast Iron Fittings of every description. Stocks, Taps, and Dies. Core Bars for Ironfounders.

PATENT FIRE-CLAY RETORTS.—O. BROTHERS and COMPANY, Manufacturers of O. Brothers' Patent, beg to state that these Retorts, being made in one entire operation, and in one piece, of any required shape, length, breadth, or height, are not liable to cracks and fissures, of which there is a just and general complaint; and consequently superior to, and cheaper than, any hitherto manufactured.
GREAT REDUCTION IN PRICES—30 per cent. cheaper than any other Clay Retorts manufactured.

Shape.	Sizes.	Length.	Thickness.	Price at Railway Station, Blackburn.	Price per foot run, of any required length, at Blackburn.
		feet.	in.	£ s. d.	s. d.
Dee.....	12 in. by 12 in.	8	2½	1 12 0	4 0
,, ...	14 in. by 12 in.	8	2½	1 12 0	4 0
,, ...	16 in. by 13 in.	8	2½	2 0 0	5 0
,, ...	18 in. by 14 in.	8	2½	2 0 0	5 0
,, ...	19 in. by 13 in.	8	2½	2 0 0	5 0
,, ...	20 in. by 14 in.	8	3½	2 0 0	5 0
,, ...	24 in. by 15 in.	8	2½	2 8 0	6 0
Round.....	15 in. by 15 in.	8	2½	1 16 0	4 6
,, ...	18 in. by 18 in.	8	2½	1 16 0	4 6
Oval Retort	18 in. by 12 in.	8	2½	1 16 0	4 6

All other sizes and shapes in proportion, to order.
References and further particulars may be obtained on application to the Patentee, Gas-Works, BLACKBURN.

TO GAS COMPANIES, ENGINEERS, AND MERCHANTS.

EDWIN DIXON,
WROUGHT-IRON TUBE WORKS,
WOLVERHAMPTON,
begs with the utmost confidence to solicit the order of Gas Companies, and persons using or selling Gas Tubes. Having for a long period supplied the largest Gas Companies and Consumers in the United Kingdom and the Continent with unvarying approbation, and almost exclusively the Local Boards of Health under Government Engineers, with Galvanised Iron Tubes and Connections, it has become an inducement to make such facts known.
Large Stock always being on hand, orders of any magnitude, from 10 to 100,000 feet, are executed promptly, and carefully tested by powerful hydraulic pressure before leaving the Works.
Boiler Tubes, Core Bars, Hollow Spindles, and Hydraulic Press Pipes, to resist 5000 lb. to the square inch, made on the shortest notice.
N.B.—Mr. Edwin Dixon had the honour of receiving the only Prize Medal of the Great English Exhibition, 1851, awarded to this manufacture.

M. SHEEN, Gas and Railway Lantern Maker, 90½, Holborn Hill, begs to inform Managers of Gas-Works, &c., that she continues to contract and supply Lanterns on reasonable terms, and keep them in repair by the year.

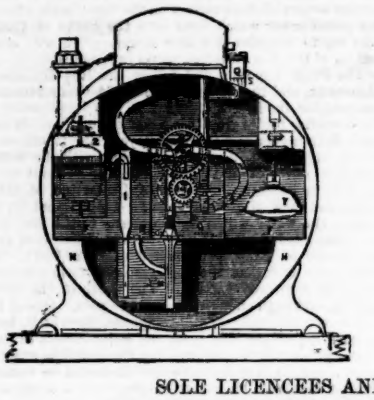
PURIFIERS FOR SALE.

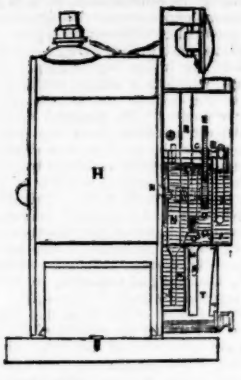
ONE Dry-Lime Wrought-Iron PURIFIER, with four tiers of Lime Sieves 8 feet by 6 feet 3 inches.
The above only used about 18 months.
One Dry-Lime Wrought-Iron PURIFIER, with three tiers of Lime Sieves 5 feet 6 inches by 5 feet.
One Dry-Lime Wrought-Iron PURIFIER, with three tiers of Lime Sieves 4 feet 6 inches diameter.
One Wet Cast-Iron PURIFIER, 7 feet 6 inches diameter, by 2 feet 2 inches deep, with Wheels and Gearing, 9 Screw-Valves 5 inches gas way.
The above will be disposed of at a reasonable price.
For further particulars apply to the LOUGHBOROUGH Gaslight Company.

CROSLEY & CO.,

GAS-METER MANUFACTURERS,

103, SOUTHWARK BRIDGE ROAD, LONDON.





SOLE LICENCEES AND MANUFACTURERS OF

W. CROSLEY'S AND CROSLEY AND GOLDSMITH'S

PATENT STANDARD SELF-ADJUSTING AND COMPENSATING GAS-METERS,

By which the True Water-Line is constantly maintained, and accuracy of measurement at all times secured.

Manufacturers of LOWE'S PATENT MOTIVE-POWER METER, for situations where there is an inadequacy of pressure to supply the special requirements of certain consumers in low grounds during the day or night.

Also, Manufacturers of EXPERIMENTAL METERS, GASHOLDERS, GOVERNORS, MINUTE-CLOCKS, PHOTOMETERS, &c. &c., similar to those used by Mr. King, of Liverpool.

C. and Co. continue to manufacture ordinary WET METERS of the very best description, Mr. W. Crosley having been for many years the principal and confidential assistant of his relative, the late Mr. Samuel Crosley, of Cottage Lane, City Road, up to the time of his decease, in which capacity he communicated to W. C. the secret of the mixture of the metals which has rendered the Crosley Meter so durable and superior to all others, as is evidenced by a large number of them being still at work, after having stood the test of nearly a quarter of a century's use.

ADDISON POTTER,

WILLINGTON QUAY,

NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire Bricks, and every description of Fire Clay Goods.

THE

EXHIBITION

OF THE

ART TREASURES OF THE UNITED KINGDOM,

NOW OPEN AT MANCHESTER.

THIS Palace, covering a Space of 18,000 Square Yards, contains the LARGEST and most VALUABLE

COLLECTION OF WORKS OF ART,

Ancient and Modern, ever collected, and which, there are many reasons for supposing, can never be brought together again.

REFRESHMENTS are provided on an extensive scale, at moderate charges.

PRICES OF ADMISSION:—From the 6th to the 16th of May (both days inclusive), 2s. 6d. for each person. On and after Monday, the 18th of May, 1s. for each person, except on Thursday in each week, when the charge will be 2s. 6d. for each person.

SEASON-TICKETS, at £2. 2s., entitle the proprietors to admission on all occasions when the Exhibition is open to the public; tickets of £1. 1s. entitle to admission on all but the "reserved days." These Tickets may be procured at the Exhibition Building; or at the Offices, 100, Mosley Street.

HOURS OF EXHIBITION.—The doors will be open daily at ten o'clock, and will be closed at sunset. A bell will be rung half an hour before closing.

CATALOGUES.—A General Catalogue, price 1s., is sold in the Palace.

BATH CHAIRS are provided at a moderate charge for the use of ladies and invalids.

Arrangements are being made with the various railway companies to enable visitors to come direct from any part of the country to the Building. The London and North-Western Railway Company have arranged to convey passengers from London by the 6.15 a.m. train, returning to London in the evening, allowing four or five hours in the Exhibition.

THOMAS HAMILTON, Secretary.

Offices: 100, Mosley Street.

EXHIBITION of Art Treasures of THE UNITED KINGDOM, 1857.—NOTICE TO HOUSEHOLDERS: APARTMENTS.—The Executive Committee having reason to believe that many of their fellow-citizens will be disposed to offer accommodation to strangers visiting Manchester during the period of the Exhibition, have determined to OPEN, for the convenience of visitors, a REGISTRY of the APARTMENTS which, upon application, may be obtained. All parties disposed are invited to send, without delay, their proposals in writing, in which must be stated the situation of the house, the number of sitting and bedrooms, and other accommodations offered, and the terms required. Further information may be obtained at the Offices, and all applications must be addressed to Mr. SAMUEL HADEN, Registrar of Apartments, No. 100, Mosley Street, MANCHESTER.

By order,

THOS. HAMILTON, Secretary.

SHEARS AND SONS'

PATENT DRY GAS METERS

Are supplied to Gas Companies and the Public as the best and simplest Dry Gas Meters in use. They are acknowledged to be of first-rate workmanship and accuracy of registration.—Shears and Sons continue to supply these Meters on the most favourable terms; and they also manufacture Wet Gas Meters, to which they apply their Patent Indices.

BANKSIDE, LONDON.

GASHOLDER, &c., FOR SALE.

THE Commercial Gas Company have for Sale, at their Bow Gas-Station, the following description of Machinery, viz.:—

One TELESCOPIC GASHOLDER, with Columns and Framing complete—Capacity, 100,000 Cubic Feet; also CONDENSERS and PURIFIERS of equal power.

The Gasholder was made by Westwood and Wright, and is in excellent working condition. Further particulars may be obtained on application to the Company's Engineer, at their Offices, situate at STEPNEY.

USED MOUTHPIECES, RETORT CONNECTIONS, VALVES, ENGINE SHAFTING, &c.

TO be Sold, at a very reduced price, a considerable number of D Mouthpieces; 3 and 4-inch Ascension, H, and Dip Pipes; several Rack Valves, from 3-inch to 12-inch; a great variety of Castings, suitable for a Gas Company.

Also, nearly 400 feet of Engine Shafting, from 2-inch to 3¾-inch diameter, with Couplings, &c., complete,

To be seen at the Equitable Gas Company's Works, Lupus Street, PIMLICO, on application to the Superintendent.

TELESCOPE Gasholder, with Wrought-Iron Tank, to be SOLD a bargain, complete with Cast-Iron Columns, Girders, Pulleys, Guides, and Weights. For further particulars apply to T. LAMBERT and SON, Short Street, New Cut, LAMBETH.

GAS ENGINEERING OFFICES,

104, LEADENHALL STREET, LONDON (EC.).

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

begs to draw the attention of Gas Companies to his Patented Apparatus, which are now specified and extensively used by Engineers, including his

DIRECT-ACTING PISTON EXHAUSTER,

which may be had, either combined with the Engine; combined with both Engine and Boiler, and Portable; or separate, by itself. Also, his

FOUR-WAY PURIFIER, CHANGING BY-PASS, & SHUT-OFF VALVE,

one of which answers the purpose of THREE ordinary Valves, in connecting Purifiers, or in shutting off and passing a Station-Meter, or other apparatus. Also his

RETORT SETTINGS,

by which any number of Retorts, up to Twenty, can be heated by one Coke and one Tar Fire, reducing the fuel account in many instances to one-half of what it now is, and without the production of any smoke.

Mr. Anderson has been extensively engaged for the last ten years in the Construction and Management of Gas-Works, and all his improvements have been brought into successful operation under his own eye previous to being submitted to the public.

Circulars, giving references and every information, may be obtained on application as above.

NOTICE.—Mr. N. DEFRIES, Consulting GAS ENGINEER, begs to inform gas companies and the public, that he is desirous of meeting any gentlemen at his WORKS, NEW ROAD, ST. PANCRAS, where, under his own superintendence of the manufacturing department, they will have the fullest opportunity of investigating the many improvements he has recently effected in his ROTARY-VALVE DRY GAS-METER, by which full security will be afforded against leakage and non-registration, even against the searching effects of Cannel Coal Gas. The Rotary-Valve Meter is warranted to register inflexibly correct at a working pressure of half a tenth, and less than a quarter of a foot per hour upon a blue light; and a guarantee will be given to all gas companies to keep it in repair for not less than five years, free of expense. With this meter the gas-supplier may fully depend upon a fair return, and the public upon having a just measurer.

GAS BATHS, GAS COOKING and HEATING STOVES, for all classes. The British Polytechnic Gas-fire, &c. Conservatories and Buildings heated by gas, and perfect ventilation secured.

Any gentleman desirous of consulting Mr. Defries in especial cases, may meet him either at his office, 145, REGENT STREET, or at his residence, 5, FITZROY SQUARE, by giving one day's notice.

Gas-works erected for private houses, where no gas company exists.

METROPOLITAN BOARD OF WORKS.

The METROPOLITAN BOARD of WORKS hereby give NOTICE that they will, on or before the 1st day of July next, receive DESIGNS from Architects, Engineers, and others, showing the best mode of laying out the Surface and Subsoil of an intended New Street in Southwark, as an example of a First-class Street; and of an intended New Street between Cranbourne Street, Leicester Square, and King Street, Covent Garden, as an example of a Second-class Street; and showing any improved means of facilitating the Traffic, and the better disposition of the Private Vaults, Sewers, Drains, Gas and Water-Pipes, Telegraph Wires, &c., with such underground or surface arrangements as may be adapted to those and other useful purposes.

The following prizes will be given for those designs which shall be adjudged to possess the highest merit:—

FIRST-CLASS STREET.

First Prize	100 guineas
Second „	50 „
Third „	10 „

SECOND-CLASS STREET.

First Prize	50 guineas
Second „	25 „
Third „	5 „

The width of the First-class Street will be 70 feet, from front to front of the houses; and the level of the Invert of the Sewer at the junction of Stamford Street and Blackfriars Road will be 1·40 above Ordnance Datum; the Invert at Wellington Street, London Bridge, 0·75 above Ordnance Datum; and the Area of the Sewer, 14 superficial feet.

The lowest level of the Crown of the Road is to be 12·55 above Ordnance Datum. Length of Street, 1130 yards.

The width of the Second-class Street will be 50 feet from front to front of the houses; and the level of the Invert of the Sewer in St. Martin's Lane 50·69 above Ordnance Datum; the Invert of the Sewer in King Street, 57·32 above Ordnance Datum; and the Area of the Sewer, 8 superficial feet.

The lowest level of the Crown of the Road is to be 67·9 above Ordnance Datum. Length of Street, 135 yards.

It is an essential condition of a First-class Street, that it should contain facilities for the supply of Gas, Water, Telegraph, and Sewer Communications to the Houses on each side of the Street, and also Leading Mains for an entire surrounding District.

A Second-class Street must contain facilities for the supply of Gas, Water, Telegraph, and Sewer Communications to the Houses on each side of the Street, without provisions for the surrounding District.

The Designs must be on Double Elephant Drawing-Paper, drawn to a scale of half an inch to a foot, and must comprise a Plan; a Longitudinal Section of a portion of the Street, taken down the centre; a Longitudinal Section near the line of the houses; and also a Transverse Section, with such descriptive details as can be shown on one sheet of Double Elephant Paper. The Drawings to be in line, and shaded (if and where necessary) in Indian Ink or Sepia only. No other drawings than those here described will be admitted to competition.

None of the Officers of the Board will be allowed to compete.

The Plans must embrace Service Connections of Gas and Water-Pipes, &c., and Surface Paving for Foot and Road-ways.

Provision must also be made for Surface Drainage, comprising Gullies, Channels, &c.

Every Design must be accompanied by an Estimate of the Cost per Lineal Yard for each class of Street.

Each design must be inscribed with a Motto, and be accompanied by a Sealed Envelope (inscribed with the same Motto) containing the name and address of the Competitor. The Designs to which Prizes may be awarded will become the property of the Board.

It is proposed that the Designs shall be publicly exhibited after the decision, and the Board therefore reserve to themselves the power of retaining all Designs sent in for the purpose of such Exhibition.

Robert Stephenson, Esq., M.P., F.R.S., President of the Institute of Civil Engineers;
Thomas Hawksley, Esq., C.E.;
Thomas Henry Wyatt, Esq., F.R.I.B.A., A.C.E.; and
George Lowe, Esq., F.R.S., C.E.;
will be associated with a Committee, consisting of
John Thwaites, Esq., Chairman of the Metropolitan Board of Works:
Alderman Cubitt, M.P.; and Alexander Wright, Esq., } Members of the Board;
assisted by the Engineer and Superintending Architect of the Board, for the purpose of deciding upon the merits of the Designs.

Should further information be required, it may be obtained on application to the Superintending Architect at this Office.

The Designs are to be sent to this Office on or before the 1st day of July next.

By order, E. H. WOOLRYCH, Clerk of the Board.

Office of Metropolitan Board of Works,
1, Greek Street, Soho Square,
April 8, 1857.

FIRST PRIZE IN THE PARIS EXHIBITION.

GAS EXPLOSIONS PREVENTED

by using the Tubes and Fittings Manufactured by

JOHN RUSSELL and CO.,

whose Goods are all well Tested and Warranted.

Inventors and first manufacturers of Lap-welded Flues for Locomotive and Marine Boilers.

John Russell and Co. are the Original Manufacturers, and at present the Holders, of the Patent for Tubes.

WAREHOUSES,
69, UPPER THAMES STREET, LONDON.

MANUFACTORY,
THE OLD TUBE WORKS, CHURCH HILL, WEDNESBURY, STAFFORDSHIRE.

WILLIAM PARKINSON AND CO.,

(Successors to the late Samuel Crosley),

COTTAGE LANE, CITY ROAD, LONDON,

Beg to announce that, in addition to the manufacture of GAS-METERS, they continue the manufacture of METERS for MEASURING WATER, SPIRITS, &c., commenced, under Patent in 1849, by the late Mr. William Parkinson.

These Meters are as simple and durable as the Gas-Meter, and as correct as that instrument in the registration of the fluids passing through them.

By Her Majesty's Royal Letters Patent.

JOSEPH BOULTON,

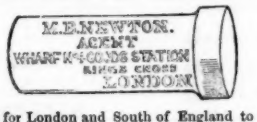
PATENT DRY GAS-METER MANUFACTURER, and also Maker of his Improved WATER METERS.

No. 28, BAGNIGGE-WELLS-ROAD, CLERKENWELL, adjoining the Police Office.—Late of No. 1, Coppice-row, LONDON.

Experimental and Station Meters of any size made to order on the shortest notice.—Governors, Pressure Registers, Gas-cooking Stoves, and every description of Gas Apparatus.

J. CLIFF'S

FIRE BRICKS, GAS RETORTS, &c.



Orders for London and South of England to be addressed to Mr. NEWTON, Agent for the District, Park House, Thornhill Road, ISLINGTON (N.).

N.B.—A few Retorts of each size, and a large stock of Bricks and Lumps, always on hand at the above Wharf.

THE CHEAPEST MANUFACTORY IN THE TRADE FOR

CHANDELIERS and BRACKETS

IN GLASS, ORMOLU, & BRONZE.

OUTSIDE SHOP LANTERNS,

Lined with Patent Silvered Glass.

Wrought Iron, Composition, and Tin Tube,

WITH EVERY DESCRIPTION OF

GAS FITTINGS,

ALWAYS IN STOCK.

CHANDELIERS and FITTINGS *made to Order on the Shortest Notice.*

JET MOONS, GLOBES, SAUCERS, & CHIMNEYS,

IN EVERY VARIETY, WHOLESALE AND FOR EXPORTATION.

HODGE and ROBERTS,

101, HATTON GARDEN, LONDON.

Pattern Books of Chandeliers, and also of all kinds of Gas Glasses, sent to any part of the Kingdom on application.

GEORGE CUTLER,

GASHOLDER MAKER,
No. 8, WENLOCK-ROAD, CITY-ROAD, LONDON.

Contracts for Tanks, Gasholders, Roofs, Purifiers, and all descriptions of Gas Apparatus executed on the most reasonable terms. Improved Slide Valves, Steam, and Range Boilers, and Smiths' Work, of the best materials and workmanship.

S. & E. RANSOME & CO.,

31, ESSEX STREET, STRAND, LONDON (W.C.),

beg to call attention to their

GAS HEATING & COOKING STOVES

Price, from 18s. 6d. each, and upwards.

WHOLESALE AGENTS FOR

MEAD'S PATENT DRY GAS-REGULATORS,
GODDARD'S DUPLEX & ECONOMIC BURNERS,
GAS BATHS, HEATING COILS, TORCHES, &c.

Also,

GWYNNE'S STEAM-PRESSURE GAUGES, and
JOHNSTON'S PATENT ALARM WHISTLES,
for preventing Explosions in Steam-Boilers.

Drawings and Prices sent on application.

NOTICE.—INFRINGEMENT OF PATENT.

CRICKMER'S Patent Metallic Packing

for Steam-Engines, Pistons, Piston-Rod Stuffing-Boxes, Pumps, &c.—Notice is hereby given that a perpetual Injunction of the High Court of Chancery has been obtained by Messrs. OASTLER and PALMER, trading under the Firm of ALEX. ROSS and CO., Grange Mills, Bermondsey, against Messrs. LITTLE and CHAMBERS, of Manchester, to restrain them from further infringing the above Patent; and that the above Packing can only be obtained of Messrs. ALEX. ROSS and CO., Grange Mills, Bermondsey, LONDON (the Proprietors of the Patent), or by their authorised Agents.

MILL BANDS, HOSE PIPES, & FIRE BUCKETS made to order from the best-selected Oak-Bark Tanned Leather.

Prices Current to be had on application.

ROBERT MACLAREN & CO.,

EGLINTON FOUNDRY, GLASGOW,

Manufacturers of all sizes of Cast-Iron Main Pipes, by an improved Patent. General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

NOW READY,

VOL. V. of the JOURNAL of GAS LIGHTING, WATER SUPPLY, and SANITARY IMPROVEMENT,

for 1856, price 21s., bound in cloth and lettered. A few copies of Vols. II., III., and IV. are still on sale.

W. B. KING, 11, Bolt Court, Fleet Street.

JAMES FEATHERSTONE,

ENGINEER,

Manufacturer of GASHOLDERS, IRON ROOFS, and every description of Gas Apparatus.

ALLIANCE IRON WORKS,
CLAYTON, near MANCHESTER.

JOHN BENT,

MANUFACTURER OF GAS METERS,
283, BELL BARN ROAD,
BIRMINGHAM,
(Established 1830).

Begs respectfully to call the attention of Gas Companies, Engineers, &c., to his WET GAS METER, made upon the most improved principles, the most admirable materials, and warranted to register correctly.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET,
DURHAM.

Manufactory for every description of Casting and Machinery for Gas Works and Water Works.

Warehouse in London for Cast-iron Pipes and Connections of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Office in London, Mr. E. M. PERKINS, 78, Lombard Street.

JAMES PINCHBECK,

GAS METER MANUFACTURER,
26, CAMDEN-STREET, and 9, PIERREPOINT-ROW,
ISLINGTON, LONDON.

Begs respectfully to announce to Gas Companies and Fitters, that from upwards of 20 years' practical experience, he is enabled to supply a METER combining correctness, durability, and economy.

N.B.—Repairs on the lowest scale.

PATENT GAS METER MANUFACTORY,
No. 66, Snow-hill, London.

WILLIAM SMITH,

by the improvements he has made in the Wet Meter, and which he has secured by her Majesty's Royal Letters Patent, the accuracy of their registry is rendered certain by the introduction of the adjusting slide and hydraulic, whereby a Perfect Water Level is readily obtained, and the Hydraulic precludes the possibility of abstracting water from the meter by increased pressure or otherwise, thus surmounting the great desideratum of the Wet Meter. In his Patent Equitable Gas Meter neatness and strength are combined, the backs and fronts of the case being stamped by powerful machinery out of thick plate iron (tinned or galvanized); and the internal construction is of the best metal, which will resist the action of any impurity in the gas.

Old Meters may readily have the adjusting slide and hydraulic applied, thereby having accurate measurement assured.

Station Meters, Governors, &c., made on the shortest notice.

J. JONES, Iron Merchant, 6, Bankside,

has long been known to sell the following Castings at prices lower than any other house in London:—Socket and Flange Pipes, Bends, Branches and Tees, Syphons, Lamp-posts, Rain-water Pipes, &c.; also, Hot Water Pipes, Elbows, Tees, Cylindrical and Saddle Boilers, and every Fitting for the same. Drawings and Prices of the above on application to J. JONES, Iron Bridge Wharf, 6, BANKSIDE, near the Southwark Iron Bridge.

WEST and GREGSON,

GAS-METER MANUFACTURERS, &c.

UNION-STREET, OLDHAM.

Station and Experimental Meters, Gas Pressure Registers, Gauges, Experimental Gasholders, Governors, Slide Valves, &c. &c.

W. and G. would respectfully call the attention of Gas Engineers and Managers to their Station-meters, having made and erected the largest in use at the present time, two of which may be seen at the Stockport and Liverpool Gas Works, on application to the respective Engineers.

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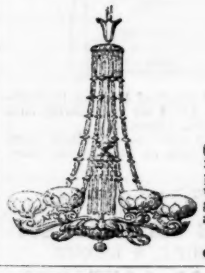

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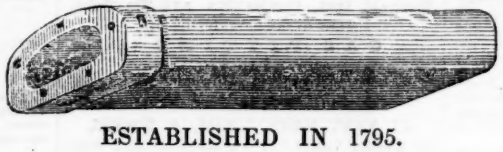

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